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AMERICAN GAS JOURNAL

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In this Centennial Year THE CONNELLY CO. developed and gave to the Gas Industry the art of purifying gas through the medium of iron oxide—which has since become the foundation of gas purification.

From One Friend To Another GREETINGS

1935

In this, its 59th year of close association with the Gas Industry, THE CONNELLY CO. again greets you with wishes for a year of increased prosperity, pledging for itself a friendly cooperation.

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CONNELLY Standard Purifying Material
Ready mixed and in bulk
Stocks carried at Elizabeth and Chicago

Improved Gas Control Apparatus

Station Governors
District Governors
Service Governors
Back-Pressure Valves
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All types of special pressure control apparatus.

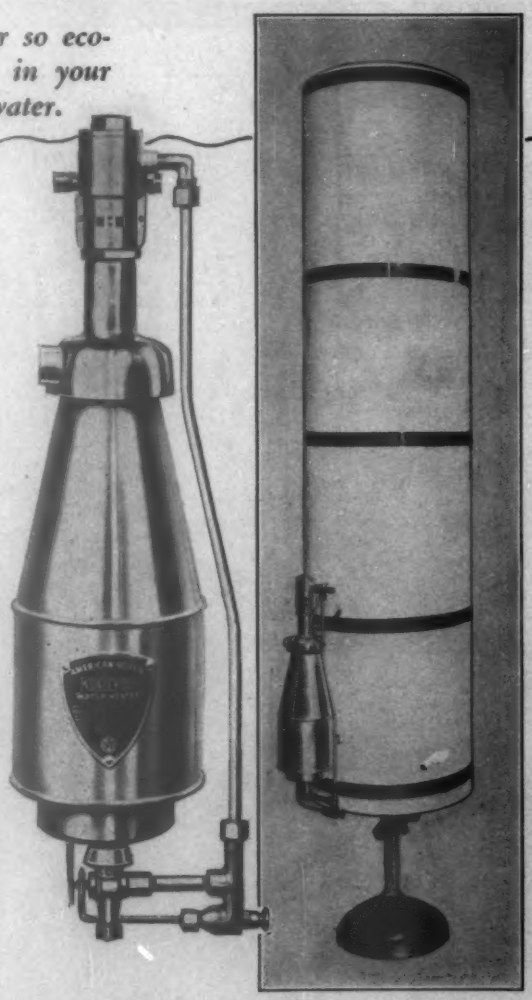
CONNELLY IRON SPONGE & GOVERNOR CO.

200 South Second Street, Elizabeth, N. J. **3154 South California Ave., Chicago, Ill.**

An American Enterprise Using American Materials and Employing American Labor

Good News for Gas Companies!

A new Automatic Gas Water Heater so economical that it enables every home in your community to afford automatic hot water.



IT supplies healthy hot water automatically . . . ever ready day or night . . . at a cost every family can afford!

It converts old-fashioned manual types of coal and gas heated tanks into modern automatic storage systems. Its first cost and its operating costs are amazingly low!

It is proving itself a powerful weapon—wherever gas companies have introduced it—in opening up a vast untouched market, and in re-selling customers as well.

Because its first cost is low, Konverto sells easily and quickly. Because its gas consumption is low, Konverto places automatic gas water heating on a competitive basis with other fuels. Because it is economical, convenient and efficient Konverto enables gas companies to keep customers sold . . . and to increase load at the same time.

Several gas companies are running successful campaigns on Konverto now during the off season—many others are already completing plans for special spring campaigns. Can you afford to delay getting acquainted with American-Bosch Konverto? Write or wire for full information.

American-Bosch, the makers of Kompak and Konverto water heaters, have for years taken pride in creating, designing, building, and selling products superior to those commonly in use. Proven leaders in their fields, these products are built up to a high standard of quality and not down to a price.

Gas Appliance Division

UNITED AMERICAN BOSCH CORP.

SPRINGFIELD MASSACHUSETTS

NEW YORK CHICAGO BOSTON PITTSBURGH

The American-Bosch Konverto is compact . . . remarkably low in gas consumption and absolutely odorless. American-Bosch insulating jacket is provided for the boiler. This jacket, ready formed of 5 ply, air-cell asbestos, is simple to install, and improves the appearance of the boiler.

NRA CODE

AMERICAN-BOSCH KONVERTO AUTOMATIC GAS WATER HEATER

AMERICAN GAS JOURNAL

Established 1859

JANUARY 1935

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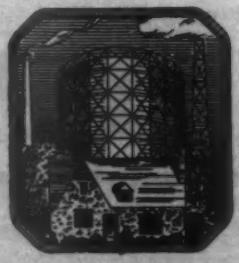

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New 75 Years Ago "Good as new" Today

San Francisco laid this cast iron pipe in the days of the Pony Express.

THIS unretouched photograph shows at the bottom of the trench an 8-inch cast iron water main installed in San Francisco in 1859 and still in service. When this old pipe was uncovered in January 1932 for the inspection of Mayor Rossi and other city officials, it had been in continuous service for 73 years and was in excellent condition. It is a section of the *first* cast iron water main laid in San Francisco.

In older cities of Europe and the United States, cast iron mains still in use, after serving 100 to 200 years and longer, were recently uncovered and inspected. All were in satisfactory condition for further service. Thus, evidence accumulates to prove that the useful life of cast iron pipe is *more than a century.*

The reason for the long life and low maintenance cost of cast iron pipe is its effective resistance to rust. Cast iron is the one ferrous metal for water and gas mains, and for sewer construction, that will not disintegrate from rust. This characteristic makes cast iron pipe the most practicable for underground mains since rust will not destroy it.

The 4 Economies of Cast Iron Pipe

1. Official records of cast iron pipe laid 100 to 200 years ago and still in service, prove that it is *cheapest in the end.*

2. Official reports on file in the office of a prominent technical publication, prove that cast iron pipe is *cheapest to maintain.*

3. Long-lived pipe obviously causes less street-opening for replacements and repairs. Therefore, cast iron pipe *saves money on street-openings.*

4. When replaced by larger pipe, or a main is abandoned or rerouted, cast iron pipe *pays a final dividend in salvage value.*

For further information, address The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 309 Peoples Gas Building, Chicago, Ill.

Methods of evaluating bids now in use by engineers rate the useful life of cast iron pipe at 100 years

CAST IRON PIPE

Look for this *trade-mark*

AS THE EDITOR SEES IT

The New Year

THE Gas Industry enters the new year facing some of the most serious problems in its history. Material and labor costs are increasing, due largely to the method adopted by the government to relieve the unemployment situation. Taxes are mounting rapidly because of a spendthrift federal policy and of the necessity of providing for the destitute. There is clamor for lower rates, in some quarters by those who are sincere but misinformed, and in others by those who are merely trying to make political capital through their attacks. Our industry is diligently seeking and would welcome ways of reducing rates without ruining its financial integrity. Competition from other fuels is keener than ever before. Furthermore, gas companies are facing additional and unfair competition from government financed electric power projects, for which they themselves are being forced to pay in part through taxes. Finally, if the prodigal expenditures of our government long continue, it seems probable that there will be inflation or further devaluation of the currency, not necessarily because the country wants it, but because it appears likely that that will be the only avenue left open. In such event the prices of material and labor may be expected to advance substantially above present levels; but adequate adjustment of rates and revenues in all probability would be secured only after long delay, if at all.

None of these problems is local in character. Virtually every one now confronts or soon will confront every gas company. Yet in the face of these, the industry looks toward the future with determination and well considered confidence. It is meeting these problems and is solving them and is going to continue to do so. But, now, at the beginning of a new year, it may be well to pause for a moment, check our position and chart our future course.

To meet the conditions which we have mentioned, the gas industry has (1) a superior and economical product, the advantages of which have never been fully publicized; (2) a record for good service not surpassed by any other industry; (3) appliances the first cost of which is less than those required in connection with electricity and, in some cases, with other fuels; (4) a corps of employees second to none in loyalty, intelligence and ability; (5) leaders of foresight, integrity and great ability and (6) a strong trade association through which the industry is united. Each of these is a very real asset, which should be used to the fullest extent in days to come.

Competition and prospective competition together with rising costs and taxes present perhaps the greatest problems to the industry. Increased sales per meter now appears the best method of meeting them. Sales stimulation might well be adopted as item number one in a national program of the industry. Modern methods, such as mass selling, should be used. Every employee should become sales-minded and lend his or her active assistance and support. Dealers should be induced to cooperate and should be given real assistance. Even manufacturers of plant and distribution equipment should support such a program as far as practicable; for if successful, new facilities will be needed to handle the increased volume of business. Rates should be adjusted to a more competitive and promotional basis as rapidly as conditions and earnings permit. Such new developments as the "Free Gas" rates of New London and Stamford, Conn., and of the Florida Public Service Company should be carefully scrutinized.

The industry should recognize that the first cost of appliances is often a more important factor in limiting expansion than the cost of the service itself. It should devise ways of overcoming that difficulty. Rental-purchase plans appear to be a step in the right direction. The object should be not only to secure new installations, but to replace every antiquated and inefficient piece of equipment on the lines with one that will give first class and economical service.

Propaganda and political attack is disturbing to both the industry and its customers. It seeks to create the impression that service from government financed power projects will be less costly, that the profits of private utilities are excessive and that courts and regulating bodies which refuse unjust requests for rate reductions are biased. Gas companies should tell their story and keep on telling it. The public as a whole is generally fair, but a favorable reaction may not be expected when there is unfavorable publicity and only silence from the other side. Tell the public what you are doing and what you are seeking to do. Let your employees understand your problems better and how to create a favorable impression with the public. It is the old story of public relations; and the industry should not be brow-beaten into silence through present unfair attacks.

Nothing is more important than that the industry continue to present a united front, and that the experience of each situation be made available promptly to all. In the American Gas Association it is fortunate in having a strong central organization through which activities are coordinated and to which its leaders give unstintingly of their time. The benefits which have accrued to all gas companies from its work are probably not realized by those not closely in touch with it. At no time has it been more important that you support it through your membership.

A word about ourselves. In these days of serious problems we are impressed with our responsibility of bringing to the members of the industry the best thought

on matters of vital interest and importance to them. It is our task to make available to all the development and successful experience of a few, to interpret these and show how they fit into the scheme of things, and thus to help in coordinating and unifying the thought of the industry along lines which will prove most successful. We shall comment editorially on matters of current importance, and in most cases shall offer constructive suggestions or criticisms. The JOURNAL reaches principally members of the gas utility industry. It is our primary endeavor to include in our columns suggestions and information of practical usefulness to them. What we say is intended not merely to be read, but to be seriously considered and to be acted upon. We desire our readers to regard the JOURNAL not merely as a publication, but as a service. We welcome inquiries whether or not they are on subjects discussed on our pages. Finally we solicit the cooperation of our readers in advising us promptly of any matters of interest to the industry that might otherwise escape our attention.

We wish to everyone connected with the gas industry a prosperous New Year. Each one of us should now put his shoulder to the wheel and help to make it so.

"Free Gas" Plan

THE new "Free Gas" Plans of the Connecticut Power Company and the Florida Public Service Company, described elsewhere in this issue of the JOURNAL, deserve the careful study of every gas company executive and rate engineer. Revolutionary and seemingly complex on first inspection, they will be found a simple, logical and forward-looking development once their object is clearly understood.

Voluntary rate reductions are generally made for the purpose of meeting competition, i. e., holding existing business and securing new consumption. How to accomplish this without sacrificing gross revenue has always been a problem. In the past some companies have sought to approximate this end through reductions in the higher blocks of their schedules, through optional rates which become economical for large consumption only, or through special class rates. All of these methods have been useful, but they have all had weak points. Some immediate reduction in gross revenue has occurred in virtually every case. The company is frequently charged with favoring the large user and neglecting the small one. The new rates have generally lacked appeal to the popular imagination, and the reductions often have been insufficiently striking and drastic to attract any substantial volume of new business. The "Free Gas" Rate is intended to avoid all of these defects and to secure new business in the face of competition.

The "Free Gas" Rate should be viewed as part of a definite coordinated plan to increase sales per meter through the inducement of a drastically lower rate schedule which automatically and immediately benefits each customer, whether large or small, when his consumption increases, but not otherwise. Gross revenues should be protected; possible charges of favoritism to large users should be eliminated, and the extent of the rate reductions for additional use and the words "Free Gas" should have a strong popular appeal.

"Free Gas" is the term which makes the plan confusing to the executive and the engineer who is used to considering rate schedules rather than sales psychology. The corollary of a lower rate is more gas for the same money. In this case the "same money" is the customer's bill during the corresponding month of the previous year, because he must increase his use in order to benefit under this plan. "More gas," the salesman speaks of as "Free Gas," because the customer pays nothing additional.

The object of the "Free Gas" rates is simple and definite. It is to transfer the users of gas from the existing level of use and existing rates to a new and higher level of use at new and lower rates appropriate to the greater consumption, at the same time protecting the financial integrity of the company both during and after the transfer period.

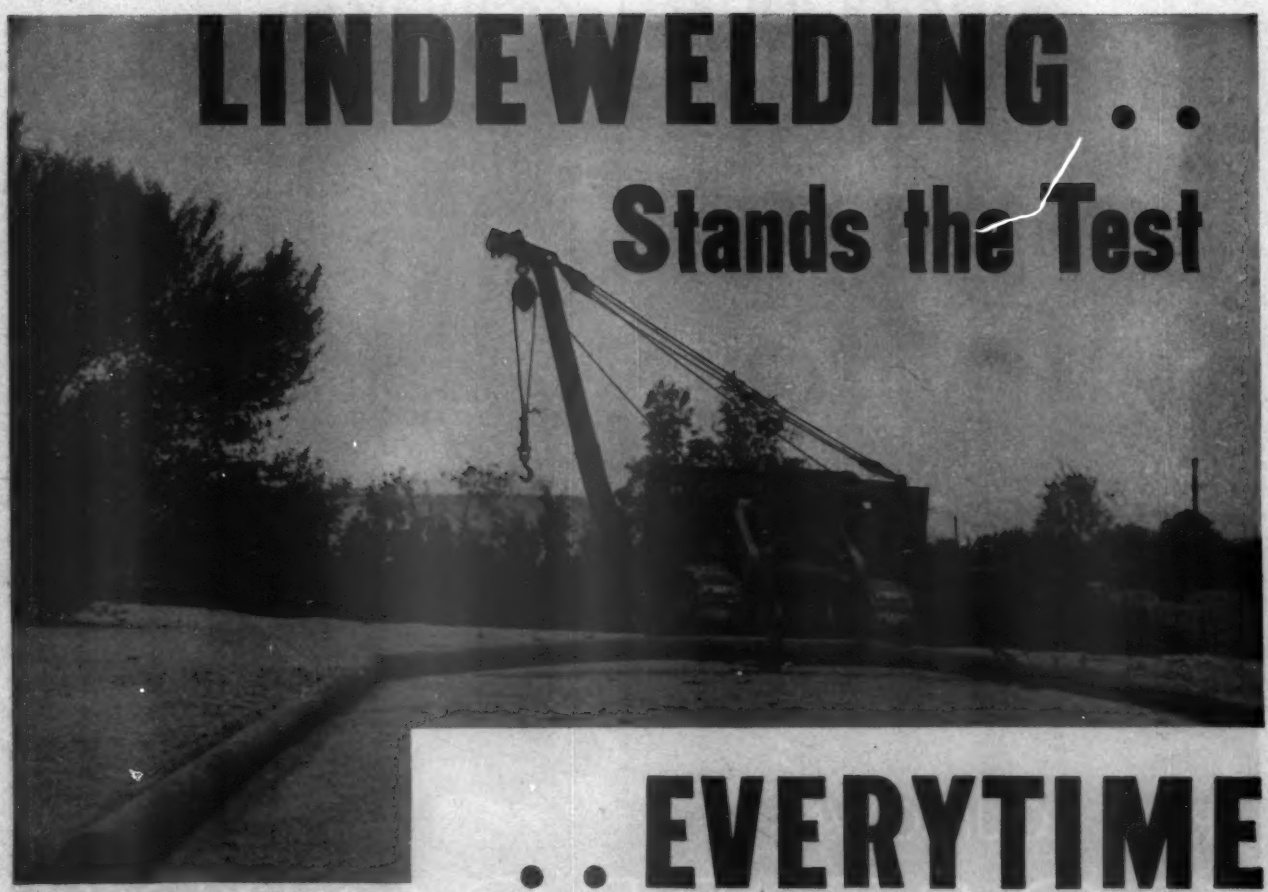
Such a change may add little if any to the earnings of a company. With lower rates, however, it should be in a far stronger position to retain existing business and to secure new business in the face of such competition as the gas industry faces on all sides.

The Florida Public Service Company has modeled its "Free Gas" plan on the "Immediate" and "Objective" rates adopted by several electric companies operating in the TVA territory. The Connecticut Power Company has a plan under which the adoption of a definite "Objective Rate" is postponed for one year, and the "Free Gas" allowance is specified instead. Fundamentally the difference is not great. Each has certain strong points. On the one hand an existing "Objective Rate" has the advantage of giving customers a feeling of reasonable permanence; on the other, with future costs of doing business so uncertain, freedom to choose an appropriate "Objective Rate" at the end of year may be a great advantage. Which plan will ultimately prove best no living man now can predict.

It is too early to say, or even to guess, what may be the success of "Free Gas" rates. Arguments may and probably will be advanced against them. Arguments are advanced against every striking new development. To us at this time they appear a logical and far-sighted development, designed, like mass selling, to meet present day conditions. We urge each company to consider this matter now,—calmly and thoroughly. Does such a plan fit your situation? You have competition. You are going to have more competition. What are you doing about it and what are you planning to do?

It is our intention to keep closely in touch with "Free Gas" or similar rate plans, and to inform our readers of further developments along this line.

LINDEWELDING . . Stands the Test



. . EVERYTIME

IT was an important gas-line river crossing. The company wanted the best job—strong, permanent, leakproof. For economy it was planned to use 1,400 feet of old 6-in. drill pipe. Would it be possible to realize all objectives? Linde Process Service was called upon for the answer.

A Linde Service Operator demonstrated that Multi-Flame Lindewelding would meet every requirement—to complete satisfaction. He instructed the company's operators in the new Lindewelding technique and followed the laying of the line through to completion. As a final proof of the strength of Lindewelding, he suggested that a three-length section of pipe containing two welds be given a bend test. One end of the pipe was secured to the columns of a railroad bridge. A tractor connected to the other end then pulled the pipe around until it bent cold through 180 degrees. None of the welds collapsed, buckled or failed.

This is how Linde Process Service works. To users of Linde Oxygen it makes available—at no extra cost—the best pipe-line welding methods, the latest welding techniques and practical assistance in organizing welding operations for best results.

The nearest Linde Sales Office will gladly furnish information on Lindewelding and Linde Process Service. These are located at: Atlanta—Baltimore, Birmingham, Boston, Buffalo, Butte—Chicago, Cleveland—Dallas, Denver, Detroit—El Paso—Houston—Indianapolis—Kansas City—Los Angeles—Memphis, Milwaukee, Minneapolis—New Orleans, New York—Philadelphia, Phoenix, Pittsburgh, Portland, Ore.—St. Louis, Salt Lake City, San Francisco, Seattle, Spokane and Tulsa. Everything for oxy-acetylene welding and cutting—including Linde Oxygen, Prest-O-Lite Acetylene, Union Carbide and Oxweld Apparatus and Supplies—is available from Linde through producing plants and warehouse stocks in all industrial centers.

PRODUCT OF A UNIT OF UCC UNION CARBIDE AND CARBON CORPORATION

The Linde Air Products Company

Unit of Union Carbide and Carbon Corporation

UCC

In Canada:
Dominion Oxygen Co., Ltd. Toronto

YOU CAN ORDER EVERYTHING FOR OXWELDING AND CUTTING FROM LINDE

● From time immemorial the question of purchasing new meters versus continued repair of old types has been debated from the standpoint of policy. ● Policies differ. But the economics do not. Your own cost, based on accurate meter records, will supply the answer. ● It is from the angle of simple economics . . . cost per meter year or per MCF and actual return on your meter dollar . . . that progressive gas company executives are weighing these factors: 1. The higher capacity ranges of modern American 5A or 5B meters . . . 2. The higher degree of accuracy and longer accurate life due to advanced design and new developments in materials and construction . . . 3. Minimum repairs and the control of replacements on an economic basis. ● American meters give you a further distinct purchasing advantage: they are priced to encourage modernization.

. . . also RELIANCE REGULATORS for close pressure control and positive lock-up.

AMERICAN METER COMPANY
INCORPORATED
Measurement and control of Gas, Oil, Steam, Air and Liquid

Meter Trade Names:
AMERICAN—D. McDONALD—METRIC—MARYLAND—PACIFIC—TUFTS

Albany Baltimore Birmingham Boston Chicago Dallas Denver Erie Kansas City
Los Angeles Philadelphia Pittsburgh New York San Francisco Tulsa

AMERICAN GAS JOURNAL
January
1935

"Share the Benefits" Rate Plan

Description of Plan and Reasons for its Adoption

By P. M. HATCH
Executive Vice President, The Stamford Gas & Electric Co.
Stamford, Conn.

THE Stamford Gas and Electric Company of Stamford, Connecticut and the New London Division of the Connecticut Power Company have recently announced a "Share the Benefits" plan. This plan places within the reach of each customer each month for one year 1500 additional cubic feet of gas free, as outlined in the following offer:

"For 12 months beginning December 1st, 1934, 500 cubic feet of increased use will be given free for each 100 cubic feet of increased use purchased up to a limit of 1500 free cubic feet per month, for each customer.

"The usage in the corresponding month of the previous year or in October, 1934 will be the basis for computing the free gas, adjusted where necessary to meet the intent of the offer (that is, an increase after December 1st, in regular usage)."

This offer is made to the public so that they may make a much greater use of gas in each household with only a small additional expense, sufficient to cover increment costs to the company of the additional gas taken under the offer. It is made with the hopes and expectations that because of the greater use per customer, a new and lower rate may be introduced which will further stimulate a fuller use of gas, particularly in the home.

The offer has come about in attempting to apply the Hartford plan of free electricity to the gas business of Stamford and New London.

The cycle of increased customer use, greater earnings, and rate reductions in the electric end of the business has been carried on continuously and effectively during the past 25 years. The average company has experienced an increase in electric use of many hundred per cent; at the same time the price to the consumer has been halved, retaining a most satisfactory net revenue for the company.

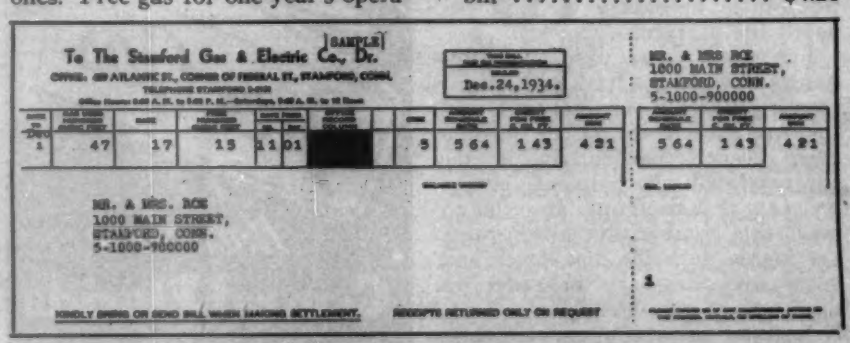
The gas company has not experienced that increased customer use, with its attendant greater revenue, which would permit it to lower its rates to the point of stimulating such a full use of the product as the conveniences of the product warrant.

There are many ways in which a customer may make complete use of this offer. One of the greatest conveniences of all is hot water service. Fifteen hundred additional cubic feet of gas burned under the tank water heater adds a convenience only surpassed by the service from an automatic water heater. The low priced, low demand, automatic water heater with its use of 4000 cubic feet per month and less, and selling for less than $40, is, under this plan, within the reach of everyone. The kitchen —the home of the breakfast—can now be warm during those early hours either through gas heat in new appliances or in the already existing ones. Free gas for one year's operation of an Electrolux gas refrigerator is a result of this offer. Complete use of this offer will remove the inconvenience of the competing oil burning apparatus in many homes.

An example of how free gas works out is given in the following statement presented to each customer with his first month's bill:

"Mr. and Mrs. Roe have used gas for cooking only. This service required 1700 cubic feet of gas. Monthly bill $2.54. They wish to enjoy the convenience of a plentiful automatic supply of piping hot, gas heated, water. They install a Konverto, attached to the present hot-water tank (75c a month rental purchase plan), to replace present unsatisfactory methods. To supply 40 gallons of hot water a day Konverto requires 3000 cubic feet of gas each month:

1700 cu. ft. plus 3000 cu. ft. equal 4700 cubic feet—costs	$5.64
BUT they get CREDIT for 1500 cu. ft. of added gas FREE	1.43
Making the net amount of the bill	$4.21


[SAMPLE]
To The Stamford Gas & Electric Co., Dr.
OFFICE: 429 ATLANTIC ST., CORNER OF FEDERAL ST., STAMFORD, CONN.
TELEPHONE STAMFORD 5-0100
Office Hours: 8:00 A. M. to 5:00 P. M.—Saturdays, 8:00 A. M. to 12 Noon
Dec. 24, 1934.
MR. & MRS ROE
1000 MAIN STREET,
STAMFORD, CONN.
5-1000-900000

DAYS IN SERVICE	LAST READING	NEXT READING	KIND	CODE	RATE	AMOUNT OF GAS	AMOUNT	AMOUNT	AMOUNT
1	47	17	15	11	01	[redacted]	5	5 64	1 43	4 21	5 64	1 43	4 21

MR. & MRS. ROE
1000 MAIN STREET,
STAMFORD, CONN.
5-1000-900000

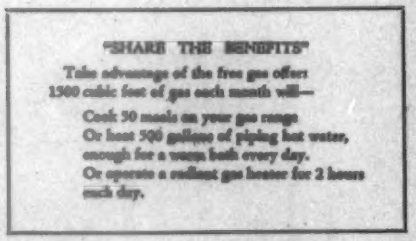
1

KINDLY BRING OR SEND BILL WHEN MAKING SETTLEMENT. RECEIPTS RETURNED ONLY ON REQUEST

Sample of invoice showing "Free Gas."

The added cost for automatic hot water service is only $1.67."

While the expenses of all gas companies have been decreased in the past few years, tremendous obstacles have recently been placed in the path of such lowering expenses. These burdens have changed our constantly lowering expenses to increased expenses. Such burdens as cost of additional taxes, increase in price of every article which a gas company purchases, larger payrolls because of shortened number of working hours, and many other increased expenses would ordinarily tend to a higher rather than a lower priced gas and certainly if the gas companies wish to keep their prices the same, they must increase the gas consumption per customer.


"SHARE THE BENEFITS"

Take advantage of the free gas offer: 1500 cubic feet of gas each month will—

Cook 90 meals on your gas range
Or heat 500 gallons of piping hot water, enough for a warm bath every day.
Or operate a radiant gas heater for 2 hours each day.

Portion of reverse side of invoice

This plan is presented at a time when it is needed by and should be particularly acceptable to the general public, and also at a time when the plant and distribution and organization facilities of a gas company need not be increased to adequately take care of the resulting increase in gas made and distributed because of this offer.

The success of the "Share the Benefits" plan depends a great deal upon customer acceptance of it. If this acceptance should be 100%, the free gas which this company would put through its mains in the next 12 months would be 216,000,000 cubic feet.

The "Free Gas" Plan of Florida Public Service Company

By STAFF CORRESPONDENT

"REDUCED Gas Rates—Free Gas—Have Come to Central Florida" is the startling announcement appearing on the cover of a booklet distributed by the Florida Public Service Company and its affiliate Sanford Gas Company. "Free Gas,"—it is hard to imagine anything which would more quickly arrest the attention of a present or prospective gas customer, arouse his interest and curiosity and, on finding the offer genuine, make him desire to take advantage of it. The satisfaction of getting a bargain is common to all of us, and instinct to take advantage of such an offer is strong. The plan is designed to arouse customer interest and to have a powerful sales appeal.

To understand the "Free Gas" plan and the reasons for its adoption, it is necessary to look beneath the surface.

For some years past gas companies have been faced with an increasingly keen competition. In the future this is apt to become even keener, particularly if the contemplated government power program is carried out. In order to meet this competition lower rates are highly desirable, but lower unit costs are necessary in order to makes these possible. As was clearly brought out at the recent A.G.A. Convention, the principal hope of reducing unit costs is in increased sales; but these in turn are in large measure dependent on the rates. It is a vicious circle. How to break it is a serious problem.

Few gas companies are today in a financial position to make such reduction in rates as would attract any substantial volume of new business. The immediate decrease in revenue from existing business would be too great, and the volume of new business acquired too speculative. The reduction in rates should be made only if and as the business increases and should be given to those responsible for the increase. Furthermore, the opportunity of securing drastically reduced rates must be the inducement for securing increased consumption.

Front cover of announcement

The "Free Gas" plan should be viewed as a plan for taking the customers at their present consumptions and on the present rates and transferring them to a new and higher level of consumption at a lower level of rates appropriate to the increased use. The sales appeal is strong because each individual customer benefits immediately if his consumption increases. The financial integrity of the company is protected because its rates are reduced only to the extent warranted by the increased business.

The "Free Gas" rates of Florida Public Service Company became effective November 1, 1934. They were modeled after the plan adopted by Alabama Power Company, Georgia Power Company and Tennessee Electric Power Company, all of which are faced with TVA competition. The rates of all of these involve:

(1) An "Immediate" or existing rate schedule under which the customer is billed as long as his consumption is less than that during the corresponding month of the "base year." The "base year" is the year previous to the adoption of the

"Free Gas" rate, i.e., the twelve months beginning with November 1933.

(2) An "Objective" and drastically lower schedule to which each customer is automatically transferred (if to his advantage) when and only when his consumption exceeds that during the corresponding month of the "base year." *Under the "Objective" schedule the amount of the customer's bill during the corresponding month of the "base year" acts as a minimum.*

Under usual circumstances the "Objective rate will be advantageous whenever the consumption exceeds that during the "base year." However, the Florida Public Service Company has adopted two optional "Immediate" rates; and under a few conditions a customer's bill may be less than last year, even though his consumption may be slightly increased. In such case he is left on the "Immediate" schedule, it being the policy of the company to give him the benefit of whatever rate results in the lowest cost, subject of course to the restrictions contained in the schedules.

The booklet issued by the Company and mentioned at the beginning of this article contains the following explanation of the operation of the plan:

"You become eligible for this 'Gas Dividend' in any month when the amount of gas you use shows an increase over the amount you used during the corresponding month of 1933 or 1934.

IMMEDIATE RATES

Rate A				Optional Minimum Fixed Charge
5 MCF @ 20c per 100 cu. ft.	200 CF @ $1.00 Minimum Fixed Chg.			$2.75 plus 9c per 100 cu. ft.
5 MCF @ 17.5c per 100 cu. ft.	2800 CF @ 15c per 100 cu. ft.			
10 MCF @ 15c per 100 cu. ft.	7000 CF @ 12.5c per 100 cu. ft.			
30 MCF @ 12.5c per 100 cu. ft.	10000 CF @ 10c per 100 cu. ft.			
Excess @ 11c per 100 cu. ft.	Excess @ 9c per 100 cu. ft.			

"OBJECTIVE" RATE

First	500 Cu. Ft. or less	$1.00	Minimum Fixed Charge
Next	2000 Cu. Ft. or less	15c	per 100 Cubic Feet
Next	7500 Cu. Ft. or less	10c	per 100 Cubic Feet
Next	10000 Cu. Ft. or less	9c	per 100 Cubic Feet
Over	20000 Cu. Ft. or less	8c	per 100 Cubic Feet

Gas Rate Schedules Now in Effect

The company has made the following three Immediate Rates available throughout its entire territory. Which ever rate is most advantageous to a consumer for a twelve months' period will be the rate applied to that consumer.

The "Objective" Rate becomes automatically effective each month and gives to every consumer the advantage of free gas when he uses more gas in the month this year corresponding to the same month last year. It also makes additional gas available to every consumer at drastically reduced cost per hundred feet.

The "Objective" Rate is applied to number of cubic feet you actually use in month in question this year. If the resulting figure is higher than your "base bill" you pay on the "Objective" Rate. If however the resulting figure is lower than the "base bill" you pay the "base bill."

In reading the "Objective" rate schedule it must be kept in mind that the bill of the corresponding month of the "base year" (beginning November 1933) is the true minimum.

Thus far the reader may have found the term "Free Gas" somewhat of a mystery. There is little in the above schedule to explain it. Yet every gas company which has a minimum bill as part of its rate schedule has a sitution in some respects similar.

Consider how a customer's bill varies under the "Free Gas" plan. It increases in accordance with the volume used according to one of the "Immediate" rate schedules until it reaches that of the corresponding month of the "base year." There it remains constant as the consumption further increases, until it is picked up and again carried forward by the drastically lower "Objective" schedule. The possible increase in use without increase in bill the salesman calls "Free Gas."

As a matter of fact, the "Free Gas" is only a part of the benefit the customer receives. Once he is on the low "Objective" rate, he may use substantial quantities of gas for a very moderate price. "Free Gas," however, is what arouses the customer's interest, and the company tells of it in the following way.

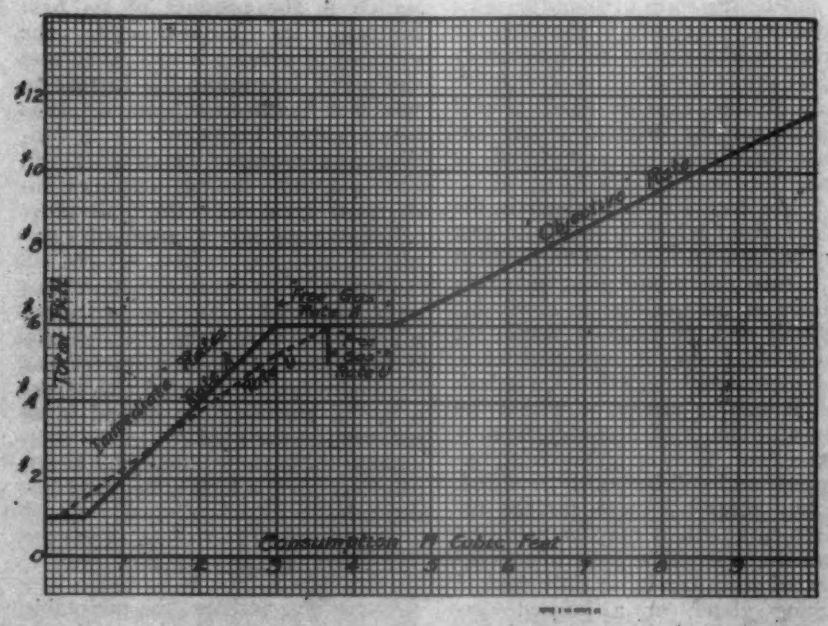


Chart showing amount of bill for different consumptions of customer whose bill for the corresponding month last year was $6.00.

How To Determine The Amount Of Free Gas To Which You Are Entitled

The accompanying table will show you the number of cubic feet you can have free if you increase your use of gas.

As an illustration of how the table works, suppose that your gas bill has been running around $4.00 a month. This would purchase 2,000 cubic feet. If you use that same amount of gas you can use 500 cubic feet more at no additional cost—or in other words should you use 2500 cubic feet your bill under the new Objective Rate will be $4.00. Each month the company will compare your gas consumption with what you used in the cor-

(Continued on page 56)

The Gas Meter And Its Maintenance*

Part 3—Shop Practice

By JOHN E. GODSOE,
Superintendent of Distribution,
Brooklyn Borough Gas Company, Brooklyn, N. Y.

THERE is no reason why a repaired gas meter should not function satisfactorily, provided proper care has been administered in the work of reconditioning it. If any one fault may be ascribed to repair methods, it is that we have modeled them too closely on those used in new meter manufacture.

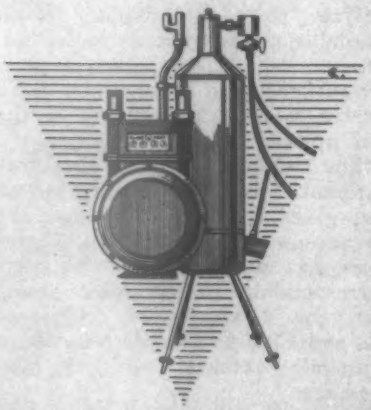
The work of fabricating new meters lends itself readily to high production methods. Not so easily does the work of reconditioning old meters. In the first instance, the assembly parts of the article are new, clean and not ravaged by use. In the second instance, the article is, to all intents and purposes, a subject for diagnosis and treatment. New meter construction is routine. Old meter reconditioning may be routine but only within certain limits.

Henry Ford builds new automobiles upon the same basis that new meters are built; but if he were in the business of reconditioning old cars, he would probably hesitate to use the same methods,—that is, if he were desirous of turning out a finished article as nearly equal as possible to a new one in service-giving qualities. Objectively, we want to turn out a repaired meter equal to a new one. Barring obsolescence and unavoidable depreciation, this can be done, but it is doubtful that it can be consistently done under the duress that usually attends where low repair cost per meter is the prime objective sought.

Meter Repair Costs

It is all very well for the repair shop manager to say, "My per meter repair cost is this or that," and then pat himself upon the back if that cost happens to be in the lower brackets. Unless he can show a maximum of service life from those repaired meters, his cost is high.

True repair cost is not arrived at by dividing operating expense



by production. A number of meters included in the production figure may have been returned from the field for faulty workmanship and short of a normal life, and these same meters may be included in the period for which another cost per meter repair is figured.

The life expectancy of a meter should be the term between periodic test dates. Its return to the shop for faulty workmanship or inaccuracy before the full span of its service life is an accrued expense which should supplement the original repair expense and must be considered as such.

A life card for each meter is the record from which true repair cost may be drawn off; and in conjunction with this, the repair shop manager will be in the position to check his methods and the class of work that is coming from his repair benches.

A meter may hold tight on a leak test, it may be proved to within the allowable limits of accuracy, it may pass a four point or small consumption test and still be poorly repaired. It may meet all these surface requirements, still it may be returned from the district because of an unsweated seam, an incorrectly packed packing gland, or a burned diaphragm. Behind the routine of diaphragm installation, casing up, fitting, topping and proving, must stand bench workmanship that is grounded upon knowledge, skill and a genuine desire to produce an article of quality.

Two meters may enter the shop at the same time. They may be of the same age, may show the same consumption and may test the same. This similarity of general characteristics is no indication that both meters may be passed through the same routine with equal results. One meter may show wear at a valve arm bearing, or a flag arm linkage, may have gum hardened diaphragms or a corroded case lip due to under sweating at the time of construction or last repair. That case lip, for instance, cannot be tinned without special treatment nor can the meter receive the same routine repairs as the other.

All of this by way of illustrating that repair work is different from new work. **In repair work it will be found that each meter has developed an individuality, which is the product of its past history, its environment, the amount of service it has given and the many intangible life factors to which it has been subjected.** It is like a human being, who at a definite age requires treatment, yet, like a human being, requires individual treatment for individual ailments and not a common cure-all.

Repair shop practice has been amply covered in papers and pamphlets with which the gas industry is familiar. The subject matter has been admirably presented and serves a useful purpose; but behind it all still reposes the need for repair technique,—those almost intangible bench practices upon which meter field life depends.

Diaphragms

Excepting, perhaps, the noticeable difference between bark aud semi-chrome tanned leather, it is difficult

*Continued from November issue.

to identify the qualities of a diaphragm. Ring material may be charcoal primes or seconds; twine may be Italian hemp or not; dressings are almost, if not entirely, unrecognizable unless an oil combination has been specified. Those shops which manufacture their own diaphragms are, of course, in a good position; but there are many shops which, due to size, must purchase diaphragms.

There are two important points involved when installing diaphragms. Both diaphragms should be of equal flexibility and weight. Where diaphragms of unequal weight or flexibility are used in the same meter, balance is sacrificed and packing glands are called upon to bear the brunt of equalization. The other point is involved when soldering the lower ring to the partition and the disc to the upper ring. Conducted heat can be highly detrimental to the leather as well as to shellac and twine. A chisel shaped soldering copper with a broad flat point, rounded at the ends should be used for bottom rings; and the meter skeleton should be tilted to an angle so that solder is equally distributed on ring and partition. Good practice is to run a bead lightly around the entire ring and then to flux the solder with the point of the copper. In disc installation, the disc itself should take most of the heat,—only the point of the copper touching the diaphragm ring.

The most troublesome point is at the diving channel where the bottom ring must be notched or bent up to make a fit. This brings the leather and twine directly against the joint that is to be made. Only the point of the copper can be used, and then only with great care. The telescope diaphragms of other days had the advantage, at least, of eliminating the hazards of conducted heat.

Method of Reoiling Diaphragms

There exists some difference of opinion as to the best method of reoiling diaphragms. Some contend for the outside method, in which oil is poured into the space surrounding the leather; while others favor the internal method, where the oil is introduced into the diaphragm through the valve seat port. The inside of the diaphragm is the flesh side of the leather and will absorb oil quicker and better than the outside, besides permitting of visual inspection of the degree of saturation. One bad practice that attends outside oiling is that of kneading the leather with the finger tips to hasten absorption. A kneaded leather is stretched and will, in time, tend to assume its original size with resultant change of proof.

Dressing oil combinations are legion. This may be due, principally, to the various gas conditions encountered. Granting that each Shop has selected a dressing best suited to its needs, it remains then that the dressing remain in the diaphragm pores as long as possible. The best method to accomplish this seems to be by the use of an oil ingredient of slower flow characteristics than the dressing oil combination. This may be used as a component of the dressing or used as dip after the leather has been saturated.

Packing Boxes

Here are important little gadgets. Usually no larger around than one's finger, they must, when packed, stand gas tight against thousands of revolutions of the crank shaft and as many movements of the flag rods. Sustained meter accuracy is much dependent upon packing. Tightly wound and shortly doubled yarn strands add to the speed with which a box may be packed; but it will not hold tight near as long as packing that is inserted in long, rather loose strands. As with diaphragm dressings, so it is with packing treatments. There are many, and frankly it would be difficult to say that any one is superior to another. Perhaps greater importance rests with quantity used than with the nature of the preparation.

Nothing is gained by leaving an excess of treatment in the wool yarn because sending the cap home will squeeze it out anyhow, and an excess of treatment prevents the insertion of enough packing in the box. A packing which, when the box cap is turned down, will force a small bead of treatment up through the cap and around the post, is sufficiently impregnated with treatment.

Center box packing is extremely important. A proof may be disturbed by as little as a quarter turn of a center box cap. The practice of running a center cap completely down and then backing it off a short distance will result in a change of meter accuracy,—not immediately, but after several hundred feet of gas has been passed by the meter. This is due to the space that is left between packing and cap when the cap is backed off. The natural resiliency of the packing together with the motion of the crank will expand the packing into the open space, and the resistance of the packing against the crank will be changed.

Center packing boxes should always be packed after the back plate seams have been run and then only when the meter is cool. The practice of packing center boxes before back plating, tends to melt out the treatment and dry up the packing.

Soldering

Soldering is a process that cannot be taught. A workman acquires the skill only by practice. Some men are naturally apt at soldering, while others fail to ever grasp the technique. They use a soldering copper in a fashion, but they cannot run a seam that is fundamentally sound.

A sweated seam is the strongest of all solder seams. In order to effect a sweated seam, however, all surfaces must be clean and tinned. A finished joint may have all of the appearances of being sweated; but unless the under surfaces are free from corrosion and oxidation the joint is not sweated, and no solderer can make it so.

Some meter manufacturers make what is known as a flat edge back plate, that is, the front portion of the plate is flat and lies close to the triangle plate when in place. When tinned and sweated, this makes a remarkably strong joint. When not sweated, it makes a very weak one. In some shops this front edge is bent over. This is all right if the bend is made to a right angle to the plane of the back plate; but when the angle of bend is something less than 90°, a weak joint will usually result.

Case lips are so constructed as to require sweating. Unless carefully tinned, this cannot be done. It is good practice after running a sweated joint on a case to return, and while the metal is still hot, to run a bead along the lip edge. This will protect the raw edge from the effects of dampness while in service.

Oil leaks, those bug-a-bears of a meter man's existence, are the results of unsweated points on solder joints. They occur, usually, at the corners of meters, which are the points at which it is most difficult to tin thoroughly. Wire brushes and scrapers are virtually worth their weight in gold; for by their judicial use, surfaces can be tinned and oil leaks will practically cease to be an annoyance.

Index Glass Glazing

Leaks at dial glasses indicate solder or packing box leaks within the top compartment of meters. If they held tight, meters could stay in service and continue to function; but aside from this is the danger that attends any gas leaks. Reglazing by picking out old putty or glazing material is very unsatisfactory. There has been a trend in recent years toward the use of a glazing material which retains plastic non-setting characteristics.

The use of this material has contributed largely toward keeping meters in the territory and reducing materially the hazards of dial glass leaks. When reglazing is done, care should be taken to leave a sufficient quantity of the glazing material between the glass and frame. If the glass is pressed tight against the frame, the amount of material is too thin to resist pressure set up by an inside leak.

Registration Tests

Four pointing is the common method used for testing the tightness of meter compartments; and if it is demanded that the flame go out on each point, the test is adequate for the purpose. It must be remembered, however, that the pressure used should be that generally encountered in the field. A meter may show tight on proving bell pressure and still show leakage when five or six inches of gas pressure is used. It is questionable that a four point test should be relied upon exclusively to determine the ability of a meter to register small demands. A valve lift, caused by a bind in a valve arm bearing, either at the crank or valve wrist, will by-pass gas between the four positions at which a meter is tested.

It seems that the more conclusive test is that of small consumption testing, wherein the meter is required to pass a predetermined quantity of gas in a predetermined time. A good plan is to four point before proving, and small consumption test afterward. Very small diaphragm and valve leaks can be detected by either method.

The custom of testing diaphragms by blocking the diaphragm port and exerting pressure on the disc, meanwhile watching the flag arm for movement, is very unsatisfactory. The use of a water column gauge on a pressure line is the only sure method.

Many meter repairers can remove what, in repair shop parlance, is known as a valve rock by the use of a punch. A valve can be made to pass a rapping test in this manner, but it can leak at the same time. The use of carborundum powder and blocks or any other recognized lapping process, properly applied, is the only unfailing method of insuring tight valves. A valve can be made to seal by applying oil to its surface; but when so treated, it will gum and will not hold tight much longer than it takes to pass a register test.

Register tests are important. With the small demands made by refrigerators, pilot and automatic lighters it is imperative that all meters pass rigorous tests.

Proving

Even though it is repetitious, proving begins at the repair bench. When valves are properly timed to diaphragm, diaphragms balanced as to weight and flexibility, packing resistances kept uniform and lost motion at bearings kept at a minimum, the proof adjuster can bring his check and open runs together without difficulty; and the proved meter will give a maximum of sustained accuracy.

Any proof adjuster will testify to the fact that some repairers' meters are more difficult to prove than meters repaired by others. An analysis of this situation will usually disclose that the difficult repairers are not timing valves closely, are careless about packing or are not taking up lost motion. Rigid inspection is the remedy.

Full revolution runs on both open and check are requisite to good proving. Fractional revolution runs are all right for general adjustment, but the operation should always be completed by a full open and a full check run. Granting tight diaphragms, granting even packing and no lost motion or binds, a meter honestly proved on full and check flows will invariably prove correct on very small flows. It is good practice to make a final inspection after proving. Tangents that are off of horizontal, due to the adjuster shifting the tangent on the crank post, may then be noticed and corrected.

Inspection

The more rigid the inspection policy, the better the finished article. There can be no compromise in this matter. Tinning, diaphragm balance, valve timing, packing, crank motion, play in bearings, index, worm gears, soldering and many other essential points should be the objects of inspection. A good inpsector is invaluable for upon his integrity and knowledge depends much in the way of what repaired meters will do in the field.

While it is customary to inspect jobs of meters before they are distributed to the repairmen, the purpose usually is to determine the general nature of repairs, such as new diaphragms, reoils or simple adjustments. If an additional step is added to the inspection at that time good results will be obtained in the way of better repairs. That step is to have the inspector determine what small parts should be replaced, such, for example, as valve and flag arms, tangents, packing boxes, worm gears, flag carriages, discs, guides, step, boots, etcetera. This removes the option of the repairer to decide what in his judgment is necessary in the way of replacements, and stock keeping is simplified.

Topping, painting and meter washing are important as are all steps in repair work. The value of spray, brush and dipping methods of meter painting together with paint qualities and colors have been amply discussed at conferences and in papers. Top leak testing is almost universally practiced, and methods are generally similar. Each shop must of necessity devise methods peculiar to itself and based upon size, volume of work handled, gas qualities and other conditions. When all is said and done, the repair shop manager is generally desirous of turning out the best, realizing as he does that his is a job wherein is vested the responsibility for accurate revenue accounting, customer welfare, and the economical maintenance of those articles which constitute the reason for the repair shop's existence.

A book might well be written upon repair work; and then much would be left unsaid that could only be acquired by standing in front of a repair bench and actually doing the work of taking meters apart and putting them together again.

Competitive Fuels for Industrial Purposes

Important Factors to be Considered When Figuring Comparative Costs

By A. M. APMANN

Derby Gas Co., Derby, Conn.

ABOUT the middle of 1931 industry generally came forth with two very pressing problems:

1. What product not now being made in our plant can be adopted for our plant equipment?

2. How can manufacturing costs be reduced?

Conferences were held, ideas sifted, and suddenly established manufacturers blossomed forth as "chiselers" in new lines. Will they go back to their original products? Who knows? Some pre-war breweries, prohibition ice plants, are again serving out golden nectar but still making ice.

Customers sensing trends forced the quasi public organizations, utility companies, into rate reductions and loss of revenues with no added business to get back revenues. Utilities then tried to introduce rates for use of service of a surplus nature, so called *off-peak*.

The Impossibility of Rate Reductions

In many cases, particularly of heavy grinding, off-peak electric schedules shifted the entire community life. The saving to the mills by night operation changed the day to night and the workman worked nights and slept in the day time. The resulting costs were used by the utilities to back up their assertion that cost of utility service was definitely better than the costs of competing fuels. The constant repetition of such information has led to further extension of utility service so that to-day the A.G.A. monthly reports show sendouts quite similar to those of the peak years. This story is, however, far from the complete one, for while rates have been dropping taxes have been increasing, and with the further increase of costs by reason of code prices for raw materials it is difficult to foresee any profit without a general revision of many rate structures looking to an equalization of the return from each customer.

It can reasonably be said, then, that a reduction in rates to those customers who now pay more than their share is practically inconceivable. The industrial gas man must therefore build his efforts on closer studies of fundamentals not only of the heating problem but of the prospective business itself.

Types of Heat Application

Heating problems and methods are basic and can be quite definitely classified into one of several simple applications. The two basic applications are direct and indirect firing. Each of these can be further subdivided into *e.g.* under or over-firing, diffusion flame, muffle, pot or tube heating and process steam. Obviously, these few examples are only illustrative of the number of methods used but the industrial man will know which method can be best used. This selection is perhaps the key of all, inasmuch as gas lends itself to any type firing possible and gives the controlled atmosphere so necessary to the highest grade finishes and results.

In the selection of the method, the industrial man will ask himself. 1. Can we have direct-flame contact without harmful results? 2. Must the furnace atmosphere be held within narrow limits? 3. Will reflected heat (radiant energy) more rapidly heat and thoroughly soak the product? 4. Can a melting operation be carried on a la hearth or must a pot be used? 5. Can immersion units be used to advantage? With those questions answered attention can be paid to other features which pertain to actual construction of the equipment and the methods of handling the product.

It is realized that every city does not have a steel mill, but practically every one has at least one tinsmith with a small utility solder iron heater and every crossroads has its newspaper. In practically every other block there is a pants presser, no longer using a tailor's iron, but a small boiler. All of these may today be gas-fired, but without attention they can fall away over night. By proper attention to the selection of the method of heating, the loss of such customers can be almost always avoided.

Public Relations Affect Salesman's Efforts

Any discussion of competitive fuels must always consider certain definite intangible factors only partially related to the fuel itself. These questions revolve about the companies offering such fuels. Public relations is a broad term, but it consists of the actions of every single individual in any way connected with an organization. It is not an imper-

sonal creature but one that reflects the attitude of each act involving the customer and a company. The customer man, so-called, takes it on the chin for snippy telephone operators, for careless service and installation men, for irregularity in billing, either of amounts or dates. Under such handicaps his efforts at selling his product are reduced because of the defense necessary to overcome other shortcomings in the organization.

The sales methods used by a man are his own personal property and should be used accordingly. It is essential, however, that every man have the same carefully-developed sales presentation, not in the sense of being an automaton but to insure the use of all facts pertaining to the merits of competitive fuels. An article, "Musical Comedy Express," in a recent issue of *Collier's* explains why the chorus after 300 performances gets a full rehearsal once a week and that Marilyn Miller warms up for a half-hour before the play starts. In the words of the author, "Staying on the top rung of Broadway's slippery ladder apparently requires something more than just a happy disposition and a wild desire to succeed." These performers sell entertainment and train and rehearse. They sell a $2.00 to $5.00 ticket—the fuel salesman sells equipment and then a monthly fuel service. How much more necessary, then, that he should have his well-developed story, rehearse it regularly and use the important parts as needed. Note the difference. The stage starts at line 1 and gets to line "Finis." There are no interruptions or questions. The salesman, however, who does that is in hot water 95% of the time. The customer can help the salesman if he is only permitted to talk and tell his side. Let him say a few words, it rests your voice and if attention is paid to his remarks the important features of the sales presentation can be stressed, leaving out those details which only confuse the issue and waste time. With the information gained by listening to the customer, the analysis of the problem can be more completely made and the solution reached by the salesman will come with authority.

Factors in an Analysis

The analysis of the competitive situation has been very often outlined, but it is always well to reiterate the fundamentals of industrial fuel comparisons to refresh and renew some phases likely to be overlooked and then square them with an actual example.

In advance of actual field experience, expected results may often require calculation of the efficiency of application. From these theoretical or actual operating data, the cost of bare fuel per unit follows. But practically never is the cost of bare fuel even close to the actual overall costs of the heating process. This results from the different types of heating and auxiliary equipment needed in the use of the various sources of heat. In a comparison between gas and oil, gas requires simple burners and mixing devices.

Blowers, Compressors and Temperature Controls

The burners themselves are closely proportioned for the consumption desired and the correct air gas ratio is a matter of choosing a complete proportioning system, a high-pressure or low-pressure air-proportioning system, whichever best fits in with plan of operation. This auxiliary equipment for gas is limited to a simple low-pressure device. Automatic control valves are equally simple in being able to act on a fuel supply unvarying in heat content and delivery pressure.

For oil firing, storage space must be provided, means for heating the less expensive grades of oil so that they may be easily unloaded and circulated to the burners. For this service an external source of steam must be used and its cost added to the bare fuel cost. The atomization of oil follows: 1—by mechanical means produced by high oil pressures, 2—by high pressure air or steam, 3—by gasification by starting with gas and continuing with some of the oil fuel itself. All of the three common methods use more elaborate, expensive equipment, which of necessity entail shorter life and higher initial service and replacement expense.

The concentration of oil fuel 140,000 B.t.u. per gallon) as against the tenuousness of gas (300 to 1100 B.t.u. per cubic ft.) is a clue to the seriousness of the problem of controlling oil fuel. In controlling, say, a flow of 100,00 B.t.u. of gas a very definite travel of a large valve head is needed to reduce to 50,000 B.t.u., but a fractional movement of a needle valve suffices for oil. The difficulty of accurately reproducing such a small movement must be unquestioned. This very inaccuracy leads to the need of a solid stack to remove surges and puffs of smoke during an adjustment.

Auxiliary Electric Equipment

Switchboards and electrical equipment are virtually the same except for the increased motor capacity required to supply the higher pressure air and greater volumes needed to insure complete oil combustion. Circulating and unloading pumps must not be neglected in arriving at the investment costs nor in the operating costs of these auxiliaries.

In the comparison of gas with electricity the lack of blowers or compressors for electric heat is apparent, but against this is the switchboards occupying as least as much space, and the exceedingly heavy conduits needed for even low heat inputs. The impossibility of throttling temperature control and long heating-up periods are always of importance, as these two factors affect the operating costs and also the investment costs as well as the supervisory labor.

Labor

Supervisory labor is a function of the complexity of any operation. Hence, the emphasis placed on automatic control. The skilled (so-called) heat treater is replaced by a boy and automatic control. No longer is there need for juggling many valves and with the simplicity of gas-fired systems, heating rapidly and throttling to the proper control point, no excess operating or supervisory labor is required. With more involved heating systems the same reduction in personnel can not result. With coal as fuel, the duties of a furnace tender become further involved because of the need for firing, trimming and cleaning the fire and removing ash and clinker. Either extra labor is used or the attention of the furnace-tender is diverted from the proper attention to the product by the need for watching the fire.

In addition to these major additions to the cost of the bare fuel are the items of freight and demurrage for coal and oil, unloading costs, storage space and deterioration during storage, interest on stored fuel and of course the greater floor space needed for the firing of coal or oil.

Improvement in Quality

A not inconsequential factor in any comparison is the improvement of the product. The improvement in quality is not always evidenced by an increase in selling price, for invariably the retort to this remark by the salesman is that the manufacturer

(Continued on page 62)

High Pressure Storage

Method of Purging Storage and Painting of Tanks to Prevent Corrosion

By ERICK LARSON

Gas Engineer

Purging Storage

THE object of purging storage is to secure safely and economically a gas mixture in the storage which can be consumed safely and without complaint, rather than to secure 100 per cent gas content. The extent to which scientific knowledge may be applied in the practical accomplishments of purging depends considerably on local conditions, availability of laboratory facilities, importance of time, size of storage, cost of gas, etc.

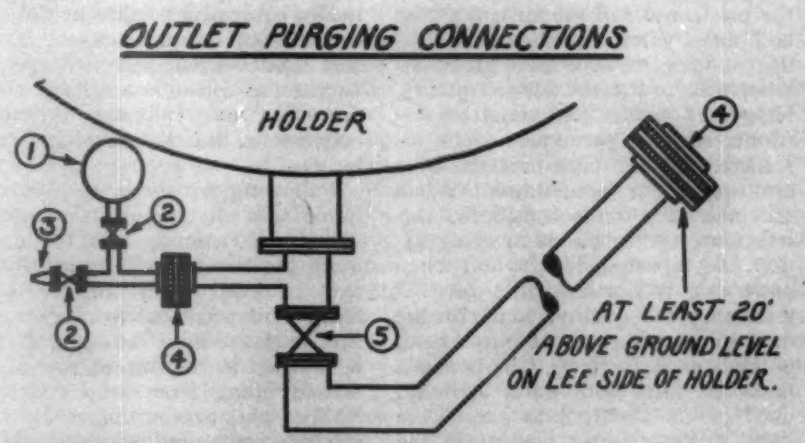
Of prime importance is safety, which consists fundamentally in using every practical precaution against explosion and fire. The safety phase of purging storage should be intensely planned, the apparatus conscientiously constructed and thoroughly checked before any gas is fed into the storage.

In general safety precautions consist in placing gauzes on all outlets open to the atmosphere, obtaining tight connections on both feed and outlet lines, eliminating any possible source of ignition including ceasing operations during thunder storms and a method of assuring the quality of the gas being satisfactory for distribution. Any wiring used for lighting circuits should be minutely inspected and installed as far as possible from the purging outlet. Effects from static electricity should be considered and any potential danger avoided.

Small storage holders having capacities of from 2,000 to 10,000 cubic feet cubical contents are numerous, and when purged, elaborate testing is unnecessary. In place of special connections for purging the permanent connecting lines to the storage are usually used on the small sizes. When the permanent connection is on the bottom or side of the holder the currents set up during the purging quickly mix the air and gas. If this mixture is allowed to flow continuously into the atmosphere more gas will be used in the purging operation than intermittently filling and draining. In the small sized compression tanks the gas will not stratify above the air as it will in larger sizes.

Small compression tanks have a drain on the bottom on which the permanent valve is usually only ¾ or 1 inch in size. The tank flange to which this drain is attached is usually 1½ or 2 inches in diameter. Removing the regular drain and temporarily installing a full sized valve facilitates purging. For safety purposes an apparatus consisting of nipples and flanges is installed and between the flanges two or more separated fine mesh screens of at least 40 mesh to the linear inch are installed between the interior of the tank and the atmosphere outlet to prevent accidentally ignited gas from entering the tank. When numerous tanks are to be purged a sampling cock on the standard equipment between tank and valve will facilitate securing samples, although by control of the gas fed into the storage the velocity of flow at the discharge can be made sufficiently high so that a hose held against the last screen or at the mouth of the discharge will provide a satisfactory sample. At least one screen should be installed previous to the test cock when used.

The outlet valve may be left open at the start of actual purging on

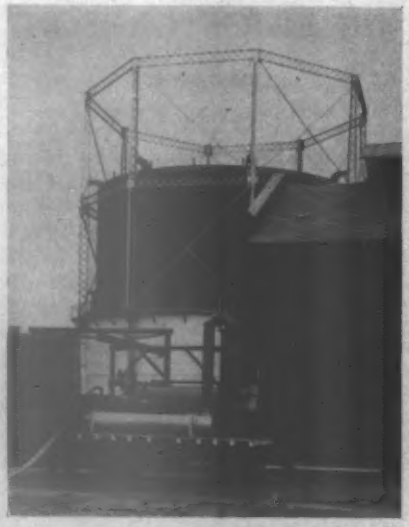


Outlet Purging Connections Fig. 30.

small tanks. The inlet valve is then slightly opened to provide a flow of approximately 1000 cubic feet per hour. A meter for measuring the quantity of gas fed into the storage is seldom installed on small sized tanks as the cost of the meter installation is unwarranted considering the total quantity of gas which may be saved by accurate measuring. The slow initial rate of gas flow is to minimize mixing of gas and air while the discharge valve is open. When the mixture discharging smells strongly of gas the outlet or discharge valve is closed and the pressure in the tank allowed to build as high as possible or permissible. During this pressure building period the rate of flow into the storage may be as high as possible without affecting the transmission or distribution systems. When the maximum pressure desired or possible is reached the inlet valve is closed.

If apparatus for testing the gravity, other physical or chemical properties is available it may be advantageously used for testing of the gas mixture at this time for the purpose of determining the quality and the quantity of additional gas required to complete purging and securing of a mixture of predetermined quality. If of unsatisfactory quality the gas mixture is then discharged to the atmosphere. The tests made may have indicated that the proper quality may be secured by an additional quantity of gas, which can be fed into the storage without discharging the total amount originally put in. When the pressure in the tanks has again reached atmospheric or the predetermined pressure the inlet and outlet valves are closed. If raising the pressure once more the maximum will furnish the desired quality, temporary connections must be disconnected and permanent ones installed when the tank pressure is at atmospheric or a minimum. When the tank mixture is considered satisfactory, as determined by computation and repeated fillings, and when apparatus is not available for determining the quality, some of the mixture may be removod into a small portable tank for tests. The portable tanks are filled with water or liquid until gas is admitted to assure the same mixture being present in the portable as in the storage tanks.

If time and expense permit, the portable tanks are taken to a regular laboratory for determining the quality of the gas. When facilities are not available for chemical or physical tests the portable tanks may be removed from the immediate vicinity of the storage and connected to a regular gas burning appliance. The adjustments on this appliance should be made under standard distribution conditions including gas of average heating value previous to the tests and not changed any time during the tests. Lack of flash back of the flame produced by the gas from the portable tanks is the usual indication of satisfactory quality. The flame on the test may have a sharper appearance and shorter inner-cone than that secured by the regular gas and still be of satisfactory quality, as additional mixing will occur when the stored gas is added to the gas from the transmission line after being placed in service. The securing of a quality of gas in the storage practically equivalent to that in the lines requires an excessive waste of gas and time without any material advantage, as consumers will not notice the slight and temporary difference between the initially stored and regular gas.



Harrison Purging Machine Fig. 31.

Following the above procedure of filling and discharging the storage tank, and assuming that the maximum pressure to which the storage may be filled is 30 lbs., the initial filling will produce an air-gas mixture in the ratio of at least 1:2. This is released to the atmosphere and a second filling from atmospheric to 30 lbs. pressure would result in a mixture containing approximately 1 part of air to 8 parts of gas. Storage is seldom constructed which can not be filled to at least 30 lbs. pressure, but if that pressure is not available the process of filling and discharging may be repeated a sufficient number of times to duplicate the result produced by two fillings to 30 lbs. A mixture of 1:8 may be safely fed into a distribution system without additional mixing, which indicates that desirable results may be accomplished without the use of meters.

The purging method of repeated fillings just explained is a safe practice, as the mixture released after the initial filling is non-explosive although inflammable. If desired, additional safety may be obtained by keeping the outlet valve closed during the entire initial filling period instead of open until the olfactory nerves register a mixture.

One of the simplest and frequently used tests to determine the air-gas mixture is the effusion bottle method of securing specific gravity. As the quantities fed into the storage can be determined from the pressure differentials, an important purpose of any additional test is to determine the uniformity of the mixture. The most desirable test results are accomplished by removal of the portable tank with its contained sample to a laboratory for complete physical and chemical analyses.

Previous to the final filling, temporary purging apparatus must be replaced with permanent fittings. Workmen should be cautioned against striking steel against steel in a manner to cause a spark during this work. The removal of the temporary, and installation of the permanent fittings should be accomplished with a slight pressure maintained in the storage to prevent air entering at the opening which might result in a small quantity of explosive mixture. Pressure may be maintained by slightly opening a temporary or the permanent inlet valve during the operation, or having all work completed before the pressure in the tank has been reduced to atmospheric. All workmen should wear masks when making the connections, as the simplest operations may consume more time than estimated.

Filling of storage with inert gases previous to purging has not been common practice in purging high pressure storage tanks mainly because of the lack of facilities, the safety with which the storage may be purged without inert gases, the usual remoteness of the storage from public by-ways and other structures and careful control of the actions of persons connected with the operation. The cost of purging small tanks with inert gases is not excessive when inert gas making machines are conveniently located either in the same or nearby utilities. The inconvenience of securing inert gas making equipment is usually the real difficulty, and in such cases the filling of stor-

age with sufficient natural or manufactured gas to exceed the explosive limit results in a high degree of safety. A precaution sometimes desirable because of local conditions is that of installing a dust catcher, or other method for removal of larger particles of foreign matter, on the feed line to eliminate the chance of such particles forcibly striking the steel at a high velocity and emitting sparks in the interior of the tank. This precaution is particularly necessary when the storage is fed from new transmission lines.

Larger sizes of storage allow for more accurate control of the mixing of gas and air. Scientific investigations both in the United States and abroad have indicated that the gases in low pressure holders stratify. Stratification was assumed to apply in high pressure holders on an air-gas mix, was proved during the purging of a 57½ ft. diameter 100,000 cu. ft. cubical content sphere type of holder during 1927 and was checked on a number of subsequent repetitions on other spheres and holders. The table below shows a few of the recorded facts.

Purging High Pressure Storage

Time	*Volume of Mixture Removed*	*Level Tested*	*Specific Gravity*	*Average Rate Per Hour from Start*
5hr. 30min.	26,000	Top	.672	4730
		¾	.692	
		½	.953	
		¼	.986	
		Bottom	.992	
11hr. 45min.	49,000	Top	.650	4170
		¾	.648	
		½	.828	
		¼	.987	
		Bottom	.997	
23hr. 15min.	87,000	Top	.633	3760
		¾	.643	
		½	.655	
		¼	.745	
		Bottom	.804	

A high pressure meter was not available so that the amount of gas entering the sphere, as shown in the table, was assumed as the quantity of mixture discharged through low pressure meters. This is practically correct, as the pressure in the sphere was maintained at an average of only a few inches water column.

Samples of gas were taken through temporarily installed pipes with the open ends at the quarter points of the vertical diameter inside of the sphere. Separate pipes were installed to each of the points from the top of sphere with the exception of the bottom point where samples were taken through a test cock on the discharge line. Each test outlet was allowed to discharge to the atmosphere for five minutes before taking the first sample, and allowed to discharge continuously while three distinct tests were completed, which tests were averaged before inserting in the above table.

The specific gravity given was determined by the effusion method. While these gravities may not be highly accurate the results may be taken as comparative. While the effusion method is subject to errors there was but slight difference between the three individual tests made at each point. The actual accuracy of the gravity may be judged by the gravity secured at the bottom point on the first two sets of tests, namely .992 and .997, when only the slightest trace of gas odor was present in the discharged mixture. Before each series of tests the comparative time for air was secured by 5 or 6 separate tests of air. Water was used as the displacing liquid in the effusion apparatus.

The average rate of feeding gas into the sphere on the initial test was purposely slow, the idea being that minimizing the rate of flow would avoid currents which would mechanically mix the air and gas. On later tanks the rate was increased to as high as 10,000 cu. ft. per hour without changing the definite stratification.

The conclusion reached was that a definite stratification occurs during the purging process when gas is fed into the top and the mixture discharged from the bottom. Stratification may be used to advantage in lessening the quantity of gas used to purge, minimizing the time required by allowing the discharge to remain open during the purging period and allowing tests to be conducted during the actual purging operation rather than at the end of any one point in the operation.

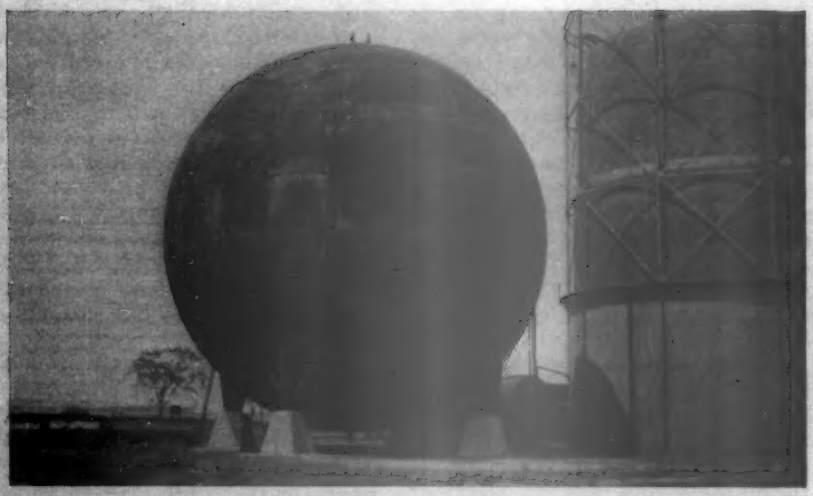
Vertical cylindrical tanks and spheres are more adaptable to stratification than horizontally constructed cylindrical tanks. On most large tanks safety valves are located on top and provide a convenient location for the inlet lines. It is undesirable to have the inlet line attached to the discharge of the safety valve and the safety valve held in an open position during purging as foreign particles may damage the seat or valve. Removing the safety valve and installing a temporary fitting is preferable. The size of the inlet line depends upon available pressures and quantities. As the lines are temporary, convenience in both construction and removal is increased by using two-inch size as that size may be easily installed by two men, whereas larger sizes would require additional help. When one two-inch line will not furnish gas at the desired rate a second may be installed from source of supply to top of holder.

The feed and discharge lines are usually constructed with screw or slip coupling joints to facilitate removal. Both lines should be constructed with the same care and tested in the same manner as any line used to convey high pressure gas. A recommended safety precaution is to relieve the joints of the weight of the pipe and also to prevent swaying action which may cause breakage of screw joints or pulling apart of slip couplings.

The discharge line or lines are necessarily larger in diameter or more numerous than the inlet pipes, as their capacity is the result of only a slight differential in pressure, whereas the inlet lines may have differentials measured in pounds. The discharge is provided with two or three screens similarly to the inlet line, and the open end carried to a point at least 20 ft. above the ground surface as an added protection against the likelihood of sparks igniting the mixture. A test cock and gauge connection installed immediately adjacent to the storage followed by a shut off valve provides greater convenience for testers.

The preferable method to measure the gas is by means of high pressure meters located on the ground immediately adjacent to the storage. A control valve is placed on the outlet of the high pressure meters for regulating the rate of flow. Placing the control valves on the meter outlet results in a higher pressure being maintained on the meters and, therefore, allows the use of smaller meters. Care must be exercised not to exceed the capacity of the meter. Some form of dust catcher previous to the meter is desirable as the flow rate is usually sufficiently high to carry considerable foreign matter.

High pressure meters are not always available but measurement of the gas used may be desirable. Governors may be installed on the high pressure feed line followed by low pressure meters and the gas carried by means of low differentials from the meters to the storage. Such a measuring design requires consider-



Mill scale practically all off of plates after only 5 months exposure. Fig. 32.

ably greater capacity of the lines between meter and storage. If the meters are installed on top of the holder the location is inconvenient or requires an additional man to watch.

The only other location is on the outlet or discharge line of the purging apparatus. When meters are installed on the discharge line a check valve is necessary between the meters and the storage to prevent damage to the meters should atmospheric temperature changes produce a vacuum in the storage. A vacuum has occurred when the rate of flow into the storage was low or temporarily stopped combined with sudden rain, wind changes and clouds obscuring the sun. Just at sundown is a period when the storage must be closely watched and a vacuum prevented by increasing the rate of gas feed or shutting the discharge off temporarily, thus allowing the pressure in the storage to build a sufficient amount to compensate for the cooling of the gas. Due to local conditions the rate of feed possible during purging operations may be so low that, due to atmospheric conditions, it would be impossible to keep a pressure in the storage during the first part of the purging period. Under such conditions, should a vacuum occur, it may be quickly relieved by allowing air to enter the storage through the discharge, removing the meters if necessary. In the early morning the atmospheric temperature rise may cause an increase in the storage pressure sufficient to damage the meters on the outlet if not controlled by the discharge valve.

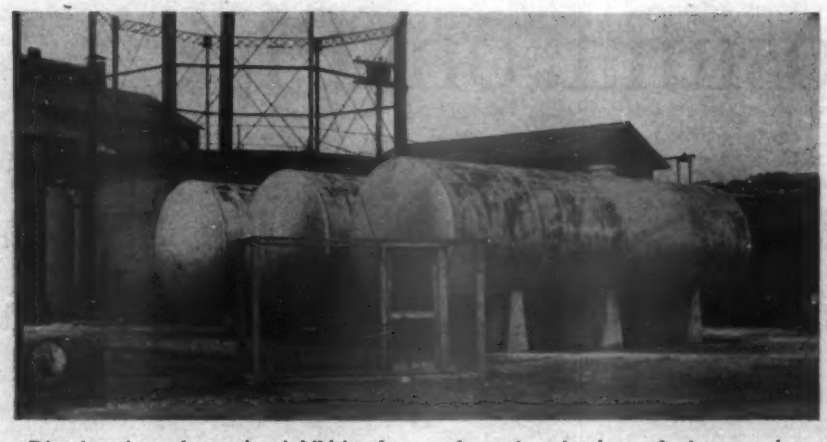
The design of the lines and apparatus for purging provides a high degree of safety if carefully installed. The nature of the work necessitates intensive checking of the installation by someone thoroughly conversant with every phase of controlling high and low pressure gas. For this reason a trained engineer in immediate charge continuously during the purging operation is a valuable addition to the other safety precautions. The engineer in charge, as well as any assistants he may have, may advantageously work in shifts if the operation consumes more than ten or twelve hours, so that there will be no tendency to become overtired and cease being cautious. No persons other than the engineer in charge and his assistants are usually allowed on the premises during the purging operation, which is conducted when no construction crews are working on or near the storage.

A recording pressure gauge installed on the transmission line at the storage feed connection will allow controlling the rate of purging so as not to affect conditions on the transmission line or nearby distribution systems. If the storage is on a sub-transmission line it is often possible during the off peak periods to feed the storage at a high rate by maintaining the pressure on the sub-transmission main at a minimum to allow proper functioning of house regulators. A recording rather than indicating gauge obviates the necessity for memorizing or recording pressures at intervals, and the trend of the transmission pressures will be available for guidance in controlling the rate of feed.

The amount of gas used in purging large storage tanks varies in practice between 80 and 110 percent of the cubical contents. The percentage depends somewhat on the pressure to which the storage can be raised after purging and previous to placing in service. A variation of twenty percent in the B.T.U. value of the final gas in the storage below that usually furnished to the consumers affected by the storage has not caused extensive complaints. When the olfactory nerves are depended upon as the test for quality, which practice should be avoided whenever possible, the maximum percentage of gas mentioned, 110 per cent, ought to be consumed for purging, as odor is unsatisfactory as a test.

After purging has been completed a slight pressure is maintained in the storage while the temporary discharge connection is removed and permanent connections attached so as to prevent air backing into the storage. While the top connection is being disconnected and permanent apparatus installed, there is usually sufficient discharge of gas, because of the difference of gravity, to prevent air entering the holder; but if not, the regular connection may be used to feed in a slight amount of gas. Workmen should wear masks during the work, as dizziness from inhaling gas may result in their falling from the structure; or when they are temporarily affected by the gas they avoidably distract the attention of co-workers from the task at hand at a time when it is desirable to complete the connections as quickly as possible. Before the regular con-

Tubercles of rust showing on a storage tank originally carefully scraped, primed and painted after nine months exposure. Shaded areas between strap and support are numerous rust tubercles. Fig. 33.



Discoloration when using inhibitive base and regular aluminum final coat paints. Note band of non-discoloration with inhibitive base and final regular oil vehicle paint. This condition after three years of exposure. Fig. 34.

nections are attached to the storage they should be purged with gas to eliminate foreign matter, and also to prevent a slug of air being carried into the mains. This air will cause consumers' appliances to go out and will be followed by gas. Even the small quantity of air or inert gas in connections may cause consumers' complaints.

While insurance against fire or explosion may be secured to cover the purging period, the rate at present is excessive and the risk is low if precautions are observed. The use of conscientious fully informed supervision and following the precautions outlined is an economy when compared to insurance costs.

The use of inert gas has not been detailed as it has been but rarely used in purging large high pressure tanks. It will no doubt be more commonly used in the future, but will add to the cost. Its application to high pressure tanks is much simpler than to low pressure holders, where difficulty is encountered in displacing the air over a large area but comparatively small height. The inert gas may be fed into the storage through the same lines used later for a gas feed. Metering on the discharge rather than the inlet overcomes the disadvantages of the high temperatures of the inert gases affecting meters. On new types of inert gas manufacturing equipment condensers are provided. Metering during the purging with inert gases may be dispensed with, and gravity tests may be used to determine complete purging.

The purging of pressure holders removed from service, requires additional precautions due to the presence of light oils or inflammable liquids. Steaming is usually resorted to as a means of removing the inflammable liquids or vapors. The American Gas Association has published a recommended practice for purging and placing gas holders in or removing them from service.

Painting

Storage plates arrive from the mill in all degrees of corrosion. Successful mill priming depends on whether all mill scale can be removed. If it is possible to remove the mill scale, priming at the mill is especially effective where facilities exist to chemically treat the plate to produce as near as possible a perfectly clean surface to receive a priming coat. Priming will partly protect the clean surface during transportation, storage and erection, but corrosion will occur where the priming is scraped off. The possibility of a mill being able to accomplish cleaning and priming of plates would lessen both initial investment and maintenance. Plate mills have as yet not developed mill priming to the extent of producing the effective coating possible in pipe mills.

Descaling in the field must be a natural process by prolonged exposure to the elements. Some firms have standard requirements, particularly on oil storage tanks, of a year's exposure before priming. The disadvantage of any specific time and also of natural descaling is the non-uniformity of the action resulting in scale free sections being exposed for periods sufficiently long to result in pitting. The small rust pits are particularly difficult to scrape or brush. Ordinary prime and finish coats placed over these pits do not inhibit corrosion; and in a few months' time small rust spots, only pin head in size, appear especially on the shaded side of the storage. These spots gradually increase in size. To scrape these spots or tubercles of rust thoroughly is difficult, so that on each repainting operation there is the need to scrape and brush some of these spots to bare metal.

In place of the commonly used oil vehicle priming paints, there are various makes of paints termed "inhibitors" or "greases." These inhibitors never dry to the extent that the oil vehicle paints do; and as corrosion occurs, the inhibitors in a limited manner penetrate to the new surface and materially decrease the rate of corrosion. In many instances they prevent the corrosion from becoming noticeable through the protective layers of paint. Numerous tubercules of rust have appeared in less than a year on tanks primed with drying paints, while the number and rate on tanks primed with inhibitors were materially less, although the tanks are immediately adjacent.

The application of inhibitive base paints is more costly, as the securing of a thin layer requires rubbing or smoothing out the paint after application. A thin coat is essential to eliminate cracking of the finish coats and also to prevent the least friction against the surface from scraping off the finish coat. Any type of paint whether the vehicle is oil or grease may be used as a finish coat. When an aluminum finish coat is desired over a grease base primer the aluminum vehicle should consist of the same type of greases used on the prime coat, otherwise after the

(Continued on page 64)

Pealing of final coat of oil base paint where initial coat of inhibitive type was too thick. Fig. 35.

Symposium on Pipe Corrosion*

1. The Prevention of Bolt and Nut Corrosion in Mechanical Pipe Joints

J. A. PERRY

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Mechanical joints for gas mains are coming into more general use. An interesting and valuable discussion of this subject by Mr. Perry appeared in our October, 1934, number. Bolts and nuts, however, are necessary on mechanical joints, and these are far more subject to corrosion and failure than the pipe itself. If mechanical joints are to be thoroughly successful and economical, means must be found to prevent rapid deterioration of the bolts and nuts. Mr. Perry here gives the report of an investigation that should go far toward solving this problem.

LATE in 1928 and during 1929, The United Gas Improvement Company through its Research and Test Department made tests of the strength of various makes of cast iron pipes for gas mains.

In 1929 it also instituted tests to determine the advisability of continuing to lay low pressure and intermediate pressure cast iron mains with the usual jute and cement packing for joints. These tests demonstrated the necessity of making a change, and convinced us that for the time being we could adopt for mains of 4" to 12" a combination joint consisting of square braided jute gaskets, Wedgetite rubber rings and cement. Several types of mechanical joints were then on the market of which three were tested and found suitable and adopted for use.

However, the long life of cast iron mains as installed in the past made it very desirable before adopting any type of mechanical joint for general use to study the designs with a view of learning, if possible, what particular type or design of joint best protected the bolts from serious corrosion, and what improvements, if any, could be made to prevent or to reduce bolt corrosion.

Our experience with the use of Wedgetite cement joints was so satisfactory that we determined to refrain from the use of mechanical joints except for mains 16" and larger in diameter, until we could satisfy ourselves by test or otherwise that the bolts of mechanical joints could be installed, so as to be easily and cheaply protected from electrolysis and/or galvanic action.

Our first tests were to subject bolts of various kinds to deterioration by means of a small current through each kind of bolt immersed in tap water and various solutions, and of course, as might have been expected, the loss of metal in each case was substantially proportional to the current discharged by the bolt.

In order to set up an accelerated corrosion condition in the laboratory which might be significant of a line discharging considerable current and still insure the same conditions for each type of bolt, five joints were made up. In each joint, one type of bolt was used. The joints were immersed in a dilute solution of sulphuric acid (spec. grav. 1.004). Under a constant potential of 2.25 volts a current was caused to discharge through the joint, and through the electrolyte to a lead cathode surrounding the joint. At the completion of the test the joints were removed and the bolts weighed. The results are given in Table 1, Test One.

As a result of this test it appeared that the bolts would be subject to corrosion which would not insure a bolt life as long as pipe life. If bolts were essential it would seem advisable to protect the bolts in some manner.

To prevent a bolt from corroding due to long line or stray railway currents it seemed logical that insulating the bolt from the pipe, clamps, or rings should materially add to its life.

A second test was therefore made using one joint with insulated bolts and one similar joint in which the similar bolts were not insulated.

Several types of joints were used in this second test and the results are given in Table 1, Test Two.

The second test indicated that the ends of the bolts were fairly close to the collector ring, and while there was a decided difference in the loss of weight between the insulated and uninsulated bolts, there was a question of what might have resulted if the collector ring had been more equidistant to all parts of the bolt.

A third test was therefore made, similar to Test Two, except that a large cylindrical collector ring placed further away from the bolts and located at the side of the bolts rather than at one end, was used.

The results of these tests are given in Table 1, Test Three.

It was computed and found that

** Abstracts from papers presented at the American Gas Association Convention, Atlantic City, N. J., October 29 to Nov. 2, 1934.*

the bolt area was 7% of the total area of the joint and therefore, should have discharged 7% of the total current. Using the electrochemical equivalent of iron (.0024) it was found that the bolts (in the order shown in Table 1, Test One) should have lost the following weights compared with the actual loss:

Bolt	Computed Loss	Actual Loss
Galvanized Steel..	.333 lbs.	1.142 lbs.
Black Steel.....	.350	1.436
Cadmium Plated.	.342	1.526
Cast-Iron "Zee Metal"	.359	1.556
Sherardized	.390	1.238

It will be seen that the cadmium plated and cast iron "Zee Metal" bolts lost 4.5 and 4.3 times as much metal as should have been lost, while black steel lost 4.1 times as much, and the galvanized steel and sherardized bolts lost 3.5 and 3.2 respectively.

The condition of the joint itself offers an explanation to this difference. As current discharged from the cast iron joint the iron was carried away leaving a graphitic deposit. Graphite was not formed on the bolts. As this graphite was formed on the joint it offered some resistance to current flow and as no appreciable amount formed on the bolts less current discharged from the joint while the discharge rate from the bolts undoubtedly increased.

Test Two was made to determine the benefits of insulating the bolts. While the second test was not exactly the same as the first, any bolt in the first test may be compared with a similar bolt in the second test if compared on the loss-per-ampere-hour basis. To show the effect of insulating the following data are taken from the two tables:

Joint	Bolt	Loss in Pounds/Ampere Hour Uninsulated	Insulated	Ratio of Loss Uninsulated/Insulated
Doublex	C. I. Zee	.000728	.000299	2.44
Doublex	Steel	.000690	.000303	2.28
C. I. Dresser	C. I.	.000714	.000297	2.40

This conclusion indicates that corrosion of bolts used in cast iron joints might accelerate with time, unless the bolt is able to build up in the soil a protective coating which will be equal to the protective coating formed on the cast iron pipe.

These data indicate that the uninsulated bolts lost an average of 2.38 times more metal than the insulated bolts.

A similar comparison of the data in Test Three follows:

Joint	Bolt	Loss in Pounds/Ampere Hour Uninsulated	Insulated	Ratio of Loss Uninsulated/Insulated
Doublex	C. I. Zee	.000458	.000133	3.44
C. I. Dresser	C. I.	.000579	.000141	4.11

TABLE I

Type Joint and Kind of Bolts	Total Ampere Hours	Total Hours	Average Amps.	Loss in Pounds	Loss in Pounds Per Ampere Hour	Loss in Per Cent	Loss in Per Cent Per Ampere Hour	
Doublex Galvanized Steel	1977	954.9	2.07	1.142	.000578	22.8	.0115	Test One
Doublex Black Steel	2081	954.9	2.18	1.436	.000690	28.8	.0138	Test One
Doublex Cadmium Plate	2034	954.9	2.13	1.526	.000750	30.5	.0150	Test One
Doublex C. I. Z. Metal	2139	954.9	2.24	1.556	.000728	31.2	.0146	Test One
Doublex Sherardized	2320	954.9	2.43	1.238	.000534	24.5	.0106	Test One
Doublex Insulated C. I. Z. Metal..	2559	1030.8	2.48	0.765	.000299	14.0	.00548	Test Two
Doublex Insulated Black Steel	2559	1030.8	2.52	0.779	.000303	14.3	.00554	Test Two
C. I. Dresser Uninsulated C. I. Bolts	2433	1030.8	2.36	1.737	.000714	26.9	.01105	Test Two
C. I. Dresser Insulated C. I. Bolts	2795	1030.8	2.71	0.830	.000297	12.7	.00455	Test Two
Steel Dresser Uninsulated Black Steel Bolts	3187	1030.8	3.09	1.394	.000437	25.8	.00810	Test Two
Doublex Insulated C. I. Z. Metal..	1943	1176.0	1.65	0.258	.000133	5.2	.00268	Test Three
Doublex Uninsulated C. I. Z. Metal	2292	1176.0	1.95	1.051	.000458	19.5	.00851	Test Three
C. I. Dresser Insulated C. I. Bolts	2339	1176.0	1.99	0.330	.000141	4.9	.00210	Test Three
C. I. Dresser Uninsulated C. I. Bolts	2300	1176.0	1.96	1.332	.000579	20.1	.00874	Test Three
Flexklamp Uninsulated Six Bolts	2136	1176.0	1.82	0.420	.000197	17.5	.00820	Test Three

From these data it will be seen that the ratio of the losses is higher than in the previous test. This is accounted for by the fact that with the lead collector ring in Test Three a larger area of the bolts was the nearest point to the collector ring than in Test Two where the nearest point was at the ends of the bolt.

The fact that the bolts in a joint are the most susceptible part of a joint to corrosion was verified by the fact that where the bolts were not insulated in Tests One and Two the body of the joint corroded considerably less than the body of the joint where the bolts were insulated. This relation cannot be shown as definitely in Test Three because the bolts in Test Three are the nearest part of the joint to the collector ring, which was located at the side, while in Test One and Two the collector ring located at the bottom of the joint was as near the joint bottom as the ends of the bolts.

Table 2 tabulates the bolt and nut losses of Test Three to better show the advantage of the insulating effect of the bolts and nuts.

Insulation of the bolts apparently reduces the loss to be expected to about one-quarter of the uninsulated bolts.

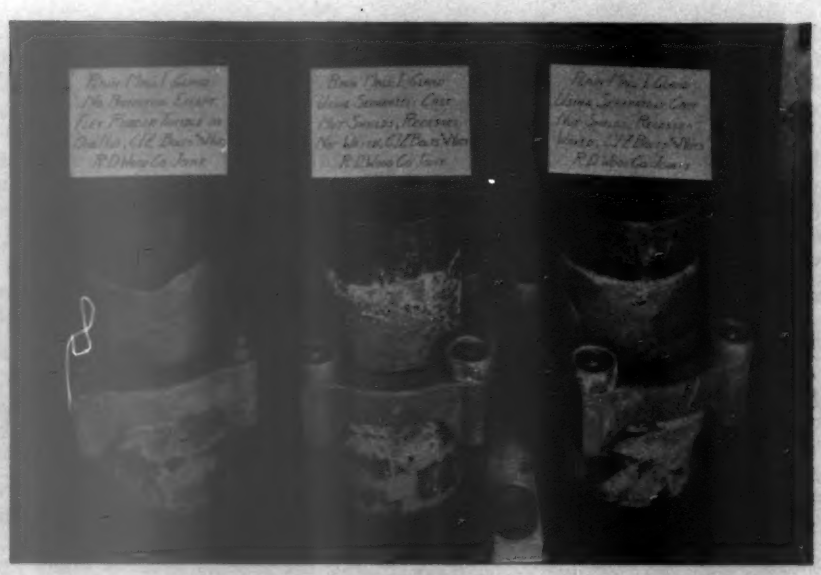
The Flexklamp bolts were uninsulated as it was practically impossible to insulate these bolts but the

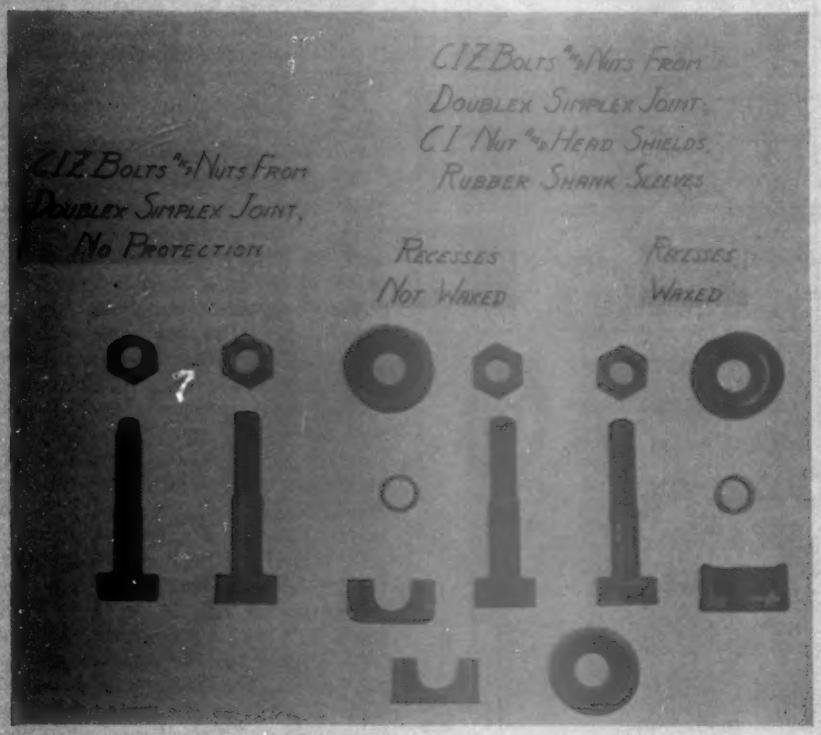
test was made on these joints to determine if the shielding of the heads and shanks of the bolts by the follower ring offered protection to the bolt. This was found to be the case, as practically all of the loss on these bolts took place on the unshielded parts, viz., the nuts and the threaded end of the bolts.

You will note that in Table 2 the percentage loss on the nuts of the insulated bolts is greater than the percentage of loss on the bolts. Even so, the loss on the nuts due to insulation is reduced compared to the loss of nuts on uninsulated bolts to approximately one-third.

The conclusions from these tests were:

1. Insulating the bolts from the joint body and pipe should materially prolong the life of the bolt where the line is subject to discharge of long line or stray railway currents. If the bolts are insulated they will be subject to local action in the soil adjacent to the bolt, but will not be subject to corrosion due to dissimilar metals, such as a bolt material different from the joint material, or galvanic currents circulating about one length of cast iron pipe.





Second Bolt from the left is equal to the originals.

2. Test Three showed clearly that if some suitable protection could be afforded to the nut and threads of the bolts of the Flexklamp type of joint that there was available at once for general use at least one type of mechanical joint that should give a life to the bolts almost equal to the life of the pipe.

Test Four was set up with eight six-inch mechanical joints, as follows:

Joint No.	*Joint Type*	*Bolt Mounting*
1	3-bolt Flexklamp	Uninsulated
2	6-bolt Flexklamp	Uninsulated
3	6-bolt Flexklamp	Nuts Capped
4	Dresser	Insulated
5	Dresser	Uninsulated
6	Dresser	Capped
7	Dresser	Uninsulated
8	Dresser	Insulated

Where the bolts were insulated, the material was Dilecto, Grade XX, a non-hygroscopic insulating material turned in the shape of thimbles.

In the case of the capped nuts with the six-bolt Flexklamp joint, the shield caps were also turned from

TABLE II—TEST THREE
TABULATION OF BOLT AND NUT LOSSES

Type of Joint	Material of Bolt and Nut	Number and Size of Bolts	Bolt Mounting	Original Weight—Pounds			Loss Weight—Pounds			Loss Weight—Per Cent		
				Bolts	Nuts	Total	Bolts	Nuts	Total	Bolts	Nuts	Total
6" Doublex Simplex	C. I. Z. Metal	6—¾"x4¼"	Insulated	3.886	1.110	4.986	0.114	0.144	0.258	2.9	13.1	5.2
6" Doublex Simplex	C. I. Z. Metal	6—¾"x4¼"	Uninsulated	4.250	1.134	5.384	0.646	0.405	1.051	15.2	35.7	19.5
6" Cast-Iron Dresser	Dresser Cast-Iron	6—¾"x8½"	Insulated	5.835	0.918	6.753	0.242	0.088	0.330	4.1	9.6	4.9
6" Cast-Iron Dresser	Dresser Cast-Iron	6—¾"x8½"	Uninsulated	5.702	0.918	6.620	1.079	0.253	1.332	18.9	27.6	20.1
6" Flexklamp	Galvanized Steel	6—⅝"x2¾"	Uninsulated	1.756	0.634	2.390	0.067	0.353	0.420	0.4	55.6	17.5

C. I. Z. Metal Bolts; Weight Loss Ratio = Uninsulated 1.051 / Insulated 0.258 = 4.08

Dresser Cast Bolts; Weight Loss Ratio = Uninsulated 1.332 / Insulated 0.330 = 4.04

rods of Dilecto. These caps were of such a size to fit snugly over the nuts and were cemented to the nut with a laboratory wax consisting of rosin, paraffin, and linseed oil, having a softening point of about 160° F. This wax held the caps in place in an effective manner.

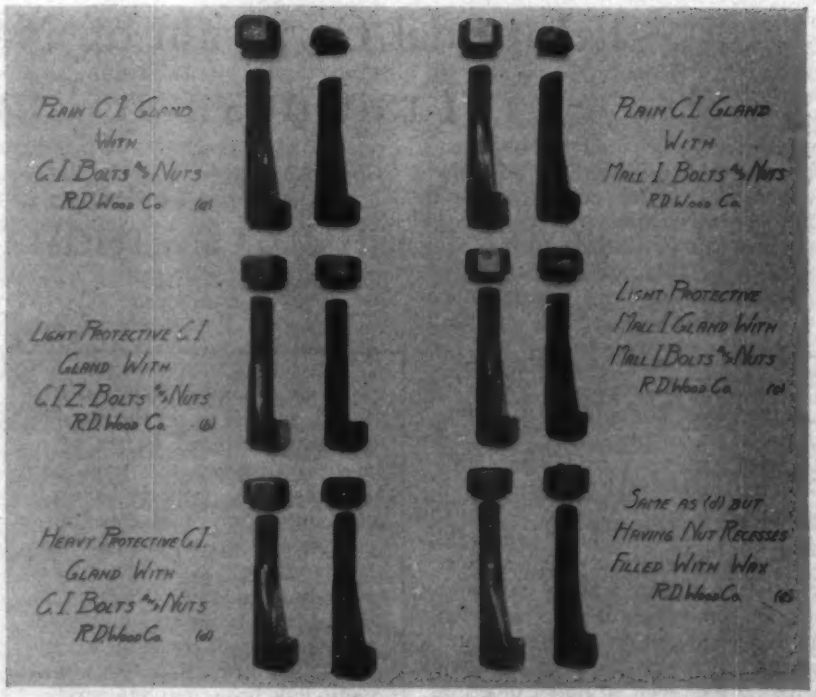
In the case of Joint No. 6, Test Four, caps of Dilecto were made for protecting the nuts and heads of the Dresser cast iron bolts used in this joint. These caps were cemented to the nuts and bolt heads with the same kind of wax described above.

For the joints where cap protection was used, no other insulation was applied.

The conclusions of Test Four are:

1. The tests on the Flexklamp joints show that suitable metallic shielding of the head and shank of the bolts should increase the life of the bolt where exposed to electrolysis or galvanic corrosion, and that capping the nuts and threads of the bolts with suitable insulating caps filled with a waterproof cementing material should greatly reduce the electrolysis and galvanic corrosion of these parts.

2. The test on Dresser joints show that we may expect the steel Dresser joints in cast iron pipe to last a smaller part of the life of the pipe itself than will steel joints in a steel pipe, since the cast iron pipe protects itself at the expense of the joint; that insulating the bolts and nuts will probably extend the bolt and nut life in service to approximately three to four times that of uninsulated bolts and nuts; that capping the nuts* and heads with suitable insulating caps filled with a waterproof cementing material should adequately protect both the nuts and heads from serious electrolysis or galvanic corrosion; and that to fully protect the bolt from serious corrosion the shank as well as the heads and nuts should be protected.


Plain C.I. Gland With C.I. Bolts & Nuts R.D. Wood Co (a)
Plain C.I. Gland With Mall. I. Bolts & Nuts R.D. Wood Co
Light Protective C.I. Gland With C.I.Z. Bolts & Nuts R.D. Wood Co (b)
Light Protective Mall. I Gland With Mall. I. Bolts & Nuts R.D. Wood Co (c)
Heavy Protective C.I. Gland With C.I. Bolts & Nuts R.D. Wood Co (d)
Same as (d) but Having Nut Recesses Filled With Wax R.D. Wood Co (e)

Bolts and Nuts at the left are in each case equal to the originals.

Doubled Shifley Joint No Protection C.I.Z. Bolts & Nuts
Doubled Shifley Joint Nut & Head Shields Cast Semi-Shifley Retaining Recesses Filled Rubber Shank Sleeves C.I.Z. Bolts & Nuts

Test Five was on the assembly of Dresser bell-face clamps. Various types of insulation were used on the rings and bolts.

Test Six might be divided into two parts, A and B.

Part A covers eight, six-inch joints of the R. D. Wood type, each joint having a follower ring, a special rubber gasket, and four three-quarter inch diameter bolts. The follower rings were designed to shield the heads and shanks of the bolts by extending the ring to form a skirt which would completely cover those parts. In this respect the follower ring is similar to the Flexklamp or Carson ring.

The conclusions from Test Six A are:

1. Shielding the heads and shanks of the bolts with a metallic shield as is the case with the Flexklamp and R. D. Wood joints should satisfactorily protect these parts of the

* Patents pending.

(Continued on page 60)

2. Internal Corrosion of Natural Gas Transmission Lines

Prepared jointly by:
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THE importance of internal corrosion of natural gas transmission lines has possibly been underestimated in many cases. Natural gas lines are, as a rule, long lines operating under high pressures and traversing a wide variety of soils. Many of these lines have been laid without adequate protection against external corrosion and in corrosive soils. In some lines failure has been due to a combination of internal and external corrosion, but the external corrosion has been so much more in evidence that the internal corrosion has often been neglected. But when the rapid external corrosion has been reduced or eliminated by known methods the slower internal corrosion becomes more apparent.

The harmful effects of internal corrosion are rather varied. If the corrosion causes severe pitting of the pipe metal, leaks will develop in the line, causing loss of gas and the expense of applying leak clamps to the line. If the corrosion removes a channel of metal from the bottom of the pipe "blow-outs" of the line will occur, accompanied by obvious hazards to life and property. If the internal pipe surface is roughened by corrosion, the capacity of the line will be materially reduced. A recent article has indicated a very definite increase of the friction factor of a natural gas transmission line that occurred as corrosion proceeded. Also, the products of corrosion occupy more volume than the uncorroded iron and may reduce the effective cross-sectional area of the pipe, thereby reducing the carrying capacity of the pipe line.

We are first interested in the conditions that must be present to cause internal corrosion. There are many natural gas transmission lines that have been in service for 20 years or longer that show no evidence of appreciable internal corrosion. But other natural gas lines have required replacement after five or six or even fewer years of service because of internal corrosion. It is evident from practice as well as theory that natural gas itself has no corrosive action on pipe lines, but certain constituents or combination of constituents that the gas may contain will corrode pipe lines under favorable conditions.

> Corrosion may occur on the inside as well as on the outside of gas pipe lines. In the past, and even now, the principal emphasis has properly been on the elimination of external corrosion, and great progress has been made in effecting a remedy. In the future it is probable that internal corrosion will receive increasing attention. The Lone Star Gas Company has been actively studying this latter subject since 1925. The authors have collected and here present exceedingly valuable and practical information on the causes and effects of internal corrosion in natural gas transmission lines.

Electrochemical Theory

A very general theory of corrosion, the electrochemical theory, requires that liquid water be present on the pipe surface and that oxygen be present in the gas passing through the pipe, before serious corrosion or rusting can occur. According to this theory the atoms of iron on the pipe surface replace some of the hydrogen ions that are present in the water. The hydrogen ions that are replaced from hydrogen gas on the pipe surface. For corrosion to proceed, this hydrogen gas must be removed from the pipe surface. Removal of this hydrogen gas in the form of gas bubbles is ordinarily slow, unless the corrosive solution is extremely acid. In normal pipe line corrosion the film of gaseous hydrogen is removed by reaction with oxygen to form water. The oxygen required for this reaction is absorbed from the gas. So the rate of corrosion is largely determined by the rate at which the hydrogen is removed from the pipe surface. The rate of corrosion may be accelerated by the presence of high concentrations of hydrogen ions in the corrosive solution. caused by the presence of acid in the solution, or by the presence of ionized salts in the solution.

Both practice and theory agree that liquid water must be present in the pipe line for corrosion to occur, unless the pipe line is operating at temperatures that are very much in excess of normal operating temperatures. Corrosion of iron by hydrogen sulphide in the absence of liquid water is not appreciable until the iron reaches a temperature above 400° F. At temperatures within the range of pipe line operating temperatures, compounds that are normally corrosive when associated with liquid water become non-corrosive when absolutely dry. For example, concentrated sulphuric acid, free from water, may be shipped in ordinary steel tank cars. Also, pure, dry hydrogen sulphide gas may be stored and shipped under pressure in ordinary steel cylinders.

In all reported cases of serious internal corrosion of pipe lines, oxygen has been present in the gas. Practice has clearly indicated that oxygen must be present for serious corrosion to occur. And even if all other factors favorable for corrosion are present, such as high line pressure, high hydrogen sulphide concentration, and liquid water on the pipe surface, serious corrosion probably will not occur unless oxygen is also present. For example, a large natural gas transmission line is taking gas from pressure wells in New Mexico. The hydrogen sulphide content of the raw gas is in excess of 200 grains per 100 cu.ft. and is reduced to about 10 grains per 100 cu.ft. of gas by scrubbing with a soda ash solution. This scrubbing saturates the gas with water vapor at line pressure and at a temperature normally in excess of line temperature, and consequently will cause condensation to occur in the line.

But the gas does not contain any free oxygen and internal corrosion of the line is reported to have been negligible since its installation some six years ago. It is certain that corrosion of this line is much less serious than it would have been if traces of oxygen were present in the gas. However, some dust is present in the gas leaving the line, indicating the possibility of some corrosion. In this connection, Speller showed appreciable corrosion rates for steel when treated with wet hydrogen sulphide in the absence of air or oxygen. On the other hand, the P.C.G.A. committee have concluded that corrosion by hydrogen sulphide will be very much reduced if the oxygen concentration of the gas is reduced, or eliminated.

Hydrogen Sulphide Effects

In cases where natural gas is free of oxygen but contains appreciable concentrations of hydrogen sulphide (more than two grains of hydrogen sulphide per 100 cu.ft.), trouble may be experienced with corrosion of copper and brass fittings on domestic appliances, even though no trouble is experienced in the iron distribution lines. This is particularly noticeable in brass or copper pilots as used on domestic water heaters, ranges, etc.

The exact role of oxygen in accelerating hydrogen sulphide corrosion of pipe lines is not definitely known. It is possible that oxygen affects the nature of the scale formed by corrosion so as to permit further corrosion as well as causing depolarization. In the absence of oxygen a dense, black adherent scale is found inside the pipe, composed largely of iron sulphide, that protects the uncorroded metal from the further action of hydrogen sulphide. In the presence of oxygen the scale is not uniformly black, but appears as more of a flaky, brown-black scale, or as nodules on the pipe surface. This scale is much more porous and less adherent than the scale formed in the absence of oxygen, and apparently offers much less protection to the underlying layer of uncorroded metal. The color of the scale appears to become more black and less brown as the partial pressure of free oxygen in the gas decreases.

Hydrogen sulphide and carbon dioxide are the acid constituents most commonly found in natural gas. Carbonic acid is an extremely weak acid, and probably has but little effect on pipe line corrosion.

Hydrogen sulphide is also a very weak acid. However, in the presence of liquid water and oxygen it will react readily with iron or iron oxides. A very large percentage of the internal corrosion of natural gas transmission lines has been shown to occur in the presence of hydrogen sulphide, free oxygen, liquid water, and high pressure. Also, serious corrosion may occur when one or all of these factors are present in extremely slight concentrations. In fact, corrosion of copper has been reported when exposed to a gas containing less than 0.01 grains of hydrogen sulphide per 100 feet, and less than 0.1% oxygen, with a gas pressure of from 375 to 400 pounds per square inch gauge. Devine, Wilhelm and Schmidt have attempted to correlate the quantitative effects of these various factors on corrosion rates of pipe steel. They found the rate of corrosion to increase directly as the absolute pressure with other factors held constant. Corrosion also increased directly as the hydrogen sulphide content of the gas. These authors found the oxygen/hydrogen sulphide ratio to be more useful in considering the effect of oxygen on corrosion rate than the absolute concentration of oxygen. The corrosion rate was found to increase with increase in the oxygen/hydrogen sulphide ratio, until the volume of oxygen present was 114 times the volume of hydrogen sulphide present. Any further increase in the oxygen content appeared to be without much effect on the corrosion rate. It might be pointed out that this ratio of 114 volumes of oxygen per one volume of hydrogen sulphide will be obtained with a very low concentration of oxygen present when the concentration of hydrogen sulphide is also low. For example, a gas containing 0.10 grains hydrogen sulphide per 100 feet would require

$$\frac{0.10}{630} \times 114 = 0.0181\%$$

by volume of oxygen for the desired oxygen/hydrogen sulphide ratio. This small concentration of oxygen would be impossible of detection by ordinary analytical methods.

From the available data on hydrogen sulphide corrosion, it is evident that the combination of hydrogen sulphide, free oxygen, liquid water, and high operating pressures are necessary before the corrosion will be severe. The corrosion rate in steel pipe may be assumed to be roughly proportional to the partial pressure of hydrogen sulphide in the gas, so long as liquid water is present and the concentration of oxygen is more than 100 times the concentration of hydrogen sulphide. The available data is insufficient to permit any accurate estimation of the rate of corrosion that will occur with a given partial pressure of hydrogen sulphide in the gas. The data presented by Devine, Wilhelm and Schmidt have been compared with the observed results of corrosion of a natural gas transmission line. This line has been operating under pressures of from 200 to 400 pounds per square inch. The gas entering the line has contained about 1.5% of oxygen by volume, and about 1.3 grains of hydrogen sulphide per 100 cubic feet. Moisture has been present in the line at all times. The above authors indicate a pipe line life of about five years under these conditions. The actual life of the first 1.5 miles of line was about eight years. However, several individual joints of pipe in this line required replacement after about four years of service.

Although most of the serious cases of internal corrosion of pipe lines that have been reported have been caused by hydrogen sulphide, other corrosive agents may cause trouble in some localized cases. For example, in one specific case, iron chloride was found to be present in drip liquor from a line. Investigation showed that water used in a gas cleaner was the source of the chlorides. The gas carried some entrained water out of the cleaner, and the water supplied to the cleaner contained large concentrations of chlorides, so the chlorides entered the line in this way.

Adding Inert Gas

In order to stabilize the calorific value of gas for distribution where the raw gas varies through a wide range of heat value, some gas companies add inert gas composed mainly of nitrogen. If the inert gas is prepared by burning natural gas in air to produce a gas composed largely of nitrogen and carbon dioxide, serious line corrosion will occur, due to the formation of oxides of nitrogen in the gas during combustion. These oxides of nitrogen are formed in all normal natural gas flames, but in normal practice they have no corrosive action. However, if the products of combustion are compressed to pressures considerably above atmospheric pressure and then cooled to atmospheric temperature, the corrosive action of the oxides of nitrogen becomes very evident due to the formation of nitric acid under these conditions.

Corrosion of pipe lines may usually be detected by analyses of drip

liquors obtained from the lines. However, in the case of hydrogen sulphide corrosion, only about 50% or less of the corroded iron is usually removed from the line in the drip liquors. Also, drip liquors from lines containing low concentrations of hydrogen sulphide and an appreciable concentration of oxygen will contain most of the sulphur combined as sulphate rather than as sulphide.

Analysis of the discharge gas for dust may also indicate the presence of internal corrosion, though this method is far less reliable than the drip liquor analysis. But when dust-free gas enters the line, and gas laden with iron-bearing dust leaves the line, it is very probable that internal corrosion is occurring.

As a rule, dust caused by corrosion has been found to consist predominantly of various oxides of iron, with only small concentration of the corroding agent present. This has led to the development of a theory regarding the repeated attack of the pipe by the corrosive agent in the gas. For example, the corrosive agent reacts with metal in the upstream end of the pipe to form a soluble iron compound. Oxidation and/or hydrolysis of this compound then occurs, precipitating iron hydroxide and freeing the corrosive agent so that it may attack more metal.

The actual mechanism of corrosion is of interest, and theories to account for it have been proposed by various investigators. Some of these are very interesting, but none of them seems to have any direct practical application.

Prevention of Corrosion by Hydrogen Sulphide

Internal corrosion of gas transmission and distribution lines by hydrogen sulphide may be eliminated or alleviated in the following ways:

1. Protection of the pipe metal by applied coatings.
2. Use of pipe metal alloys that will withstand corrosion.
3. Dehydration of the gas entering the distibution system.
4. Removal of oxygen from the gas.
5. Removal of hydrogen sulphide from the gas.
6. Addition of inhibitors to the gas.

The use of protective coatings inside the pipe is receiving an increasing amount of attention. An optical device has been developed to permit complete inspection of the coating after application in small sized pipe. Cement lined pipe has been used with some success in handling corrosive gases and liquids.

A wide variety of protective films, such as lacquers, tars, greases, anti-oxidants, etc., are on the market, but seem not to have been generally accepted for use by the gas industry. One gas company on the west coast has applied an oil film to the inside of a transmission line operating under corrosive conditions by injecting a light oil into the compressor station discharge gases. It has been reported that in this instance the rate of corrosion of the line was reduced at least 75%. Glass lined and rubber lined pipe at present are too expensive to warrant their general use. Several of the new synthetic lacquers appear to have distinct possibilities for use as protective coatings inside line pipe.

At present the use of corrosion resisting alloys for pipe fabrication seems to be limited to the development of a reasonably priced pipe lined with a thin layer of a high-chrome stainless alloy. None of the less expensive alloys have sufficient resistance to hydrogen sulphide corrosion to warrant their use.

The possibilities of dehydration of gas entering the transmission system have received considerable attention. Several commercial installations have been made, with apparently good success.

In many cases, dehydration of the gas appears to offer the best solution to the problem of internal corrosion. Dehydration may be applied most advantageously in the case of high pressure distribution systems, as the gas entering such systems contains relatively little water per 1,000 cu. ft. and the load on the dehydrating system is much less than in the case of low-pressure gas. The principal operating troubles with dehydrating systems using refrigeration appear to be complete removal of the condensed water droplets from the gas, and trouble from freeze-ups. Natural gas hydrocarbons will react with water to form solid hydrates that have much higher "melting points" than that of water ice. But dehydration of the gas has the advantage of preventing corrosion due to oxygen as well as that due to hydrogen sulphide, and also prevents the accumulation of liquid water in the line, eliminating drip blowing and reducing freeze-ups of the line.

Some investigators suggest that operating practice be improved to such a point that free oxygen in the gas is substantially eliminated. This may be possible in some systems, but is obviously impossible with other systems. An economical method for the substantially complete removal of oxygen from natural gas would be welcomed by the industry. Such a method can possibly be developed.

Processes for the removal of hydrogen sulphide from gas have been the subjects of many investigations. Nearly all of the "liquid" processes, such as the soda ash process developed by the Koppers Company, will leave appreciable amounts of hydrogen sulphide in the scrubbed gas and are relatively expensive when applied to the treatment of high-pressure gas containing concentrations of hydrogen sulphide of less than five grains per 100 cu. ft. The iron oxide box will remove hydrogen sulphide nearly quantitatively if properly used. The cost of construction and operation of such boxes under high pressures is high, and prevents their use on most natural gas lines.

Liquid Scrubbing Process

The Lone Star Gas Company has developed a liquid scrubbing process for the removal of hydrogen sulphide from high-pressure natural gas containing oxygen that appears to be capable of effecting nearly as complete removal of hydrogen sulphide as the iron oxide box at a much lower operating cost. This process has been in operation on a line carrying 10,000 M. cu. ft. of gas per day for two years, and has effected a very considerable reduction in the rate of corrosion of the pipe line. The gas containing the hydrogen sulphide and oxygen is passed through a suspension of iron and zinc salts in a dilute soda ash solution. The oxygen in the gas is partly absorbed by the alkaline solution and serves to oxidize the metallic sulphides formed in the solution nearly as rapidly as they are formed. Due to this rapid oxidation the partial pressure of hydrogen sulphide over the scrubbing solution is maintained at a very low value and consequently the partial pressure of hydrogen sulphide in the scrubbed gas is maintained at a low value so long as good contact is obtained between the gas and the scrubbing solution. Cost of operation of this installation is about 0.18 cents per M cu. ft., largely due to the high depreciation rate of the scrubber caused by rapid corrosion. This depreciation cost may be decreased by the use of a stainless steel scrubber. Considerable quantities of free sulphur are formed in the process and

(Continued on page 33)

3. Review of Work on Pipe Coatings and Corrosion for 1934

By SCOTT EWING

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Soil Corrosion Surveys

ABOUT 18 months ago the research associate was directed to investigate the various proposed methods of making soil corrosivity surveys and to determine their practical utility. After spending almost a year on transmission lines on distribution systems and in the laboratory, the writer is of the opinion that soil corrosivity surveys, properly carried out, are worth while. By this is meant that with present costs of good coatings and pipe line repairs, appreciable savings can probably be made in the operation of a pipe line or distribution system by determining the corrosiveness of the soils traversed by a pipe line prior to coating or reconditioning of the line. It is frankly admitted that no one test method is reliable and no combination of them is entirely reliable, but a combination of methods has been devised which will be correct in a sufficient percentage of cases to substantially reduce operating costs. The methods could be used in distribution systems to map corrosive areas, and these maps could be used as a means for determining where coatings should be used in future construction.

The economical way to reduce corrosion losses on a transmission system might be briefly summarized as follows: (1) Use good coatings but do not adopt a policy of coating everything, because in many soils the pipe will require practically no repairs over long periods. (2) Expect to repair leaks and recondition parts of the line. Develop an organization and adopt a method for doing this work as cheaply as possible, but do not adopt an extensive reconditioning and repair policy. (3) Make soil corrosivity surveys to learn where to expect trouble but do not expect to be able to determine where every leak will occur by their use. The method described in the American Gas Association Distribution Committee Report for 1934 is a means for aiding the operator in properly balancing these three methods of combating corrosion. It is believed that the method is sufficiently elastic to be adapted to any operating condition.

House Service Questionnaire

At the Distribution Conference in 1933 the question was raised as to what should be done about the protection of services. It appeared to the subcommittee that the most logical way to attack this problem would be to collect data on services from the industry from which some idea of the extent and seriousness of service corrosion might be obtained. A service questionnaire was accordingly prepared and distributed by the subcommittee. Replies received from 188 companies distributed over 41 states and one province in Canada, and covering 6,166,000 services, were received, giving an excellent cross-section of the entire country.

The following is a summary of the replies to the questionnaire. The figures given are only approximate.

1. Installation of services
   a. Number of services. The average number of services per reporting company is 32,800.
   b. Kind of pipe. Over half the companies use steel. In order of the extent of their use the other materials are galvanized steel, wrought iron, and copper.
   c. Insulating joints. Only 16 companies use them and most of these only in special cases.
   d. Brass curb cock is used by 25% of the reporting companies.
   e. Jacking. Fifty per cent of companies use jacking part or all of the time.
2. Corrosion of services
   a. None of the companies could calculate average service life using Griswold's method.
   b. Most of the companies report no trouble from electrolysis; most of the trouble is caused by soil corrosion.
   c. 35% of the corrosion failures occur near the building wall, 12% at the sidewalk curb and 10% at the main.
3. Protection of services
   a. 25% of the companies use no coating, 25% use paints, and 50% use heavier coatings.
   b. Most companies expect a considerable increase in life, usually about 50%, by the use of the coating.
   c. A large percentage of coating failures are attributed to improper application or handling.

Summary of Replies

The discussions of the replies to the questionnaire by subcommittee members may be summarized as follows:

1. There is universal agreement that something should be done to prevent corrosion near the cellar wall since this is a very vulnerable and dangerous place. If the entire service is not coated a sleeve of larger pipe should be placed around the service pipe through the wall, extending beyond the wall both inside and outside the building. The sleeve should be filled with coal tar or similar material.

2. Nearly all the members of the subcommittee are strongly of the opinion that services should be coated.

3. The expected extension in life from the use of the coatings is probably based on fond hope rather than observed facts, and this applies especially to those who are using thin coatings.

Although the questionnaire indi-

cates a general lack of service replacement records, a few gas companies have kept such records over a long period. An outstanding example of such records is that of the Philadelphia Gas Works. These records have been used to calculate the average life of wrought iron and steel services in Philadelphia, using Griswold's method. This method is based on the assumption that the failures will occur according to the so-called Normal Distribution Law. This law implies that as the age of a given group of services increases, the frequency of failure will increase to a maximum which will occur at the average life and at which time half of the services will have failed. The frequency of failure will then decrease because of a decrease in the number of services until eventually at about twice the average life all the services will have failed. Even though only a small percentage of the services have failed at any given time, it is possible to calculate the "average service life." This method is based on an assumption which is known to be approximately correct for some other things such as electric light globes, telephone poles, etc., but its validity in the case of services has never been proved to the writer's knowledge.

Another Method

Another method, which is supported by at least some pipe line corrosion experience and measurements, may be used to estimate what will eventually happen to a group of services. The method is based upon the relations between pit depth and time and pit depth and area which were developed by Dr. G. N. Scott (A.P.I. Proceedings, Section IV, Production Bulletin 212, pp. 204-220, 1933). It is possible to account for the service failures in Philadelphia by manipulating these two relations. A few of the conclusions which follow from the analysis are: (1) The ultimate percentages of failures of Philadelphia gas services which will occur are: steel 27%, wrought iron 14%. (2) The frequency of failure will be greatest for the wrought iron when it is 70 years old and for the steel when it is 66 years old. (3) At the end of the 240th year, 7% of the total number of wrought iron services will have failed, and at the end of the 200th year 13% of the total number of steel services will have failed. These percentages are in each case half of the ultimate percentage of failures. These results follow if the relations developed by Scott are true and if the records indicate only those services which failed on account of corrosion. If only about one-fifth of all of the installed services will ever fail, it is evident that there is no such thing as average service life.

This analysis affords no explanation for the fact that the wrought iron services in Philadelphia have failed less frequently than the steel services. This may be caused by differences in the metals or differences in the soil conditions. The Hickenlooper coating, which was used on these services, is a better coating than the thin paints that are still being used by many gas companies.

The analysis is not presented as a proper or reliable method for reaching conclusions on the problem of service failures. It needs further investigation and testing on other gas properties. It is, however, a definite suggestion for attacking the problem of estimating repairs to be expected at any future time, and it affords a logical basis for determining the necessity of coating services.

But even if this analysis and the records on which it is based were entirely reliable, it is not to be expected that the services in any other system would behave in exactly the same way. The mere fact that the majority of companies use coatings is not a sufficient reason why every company should use them. Differences in operating conditions, soil conditions, etc., make each distribution system a separate problem.

Conclusions

In closing the discussion of the questionnaire, the writer would like to quote from the discussion of a subcommittee member: "One thing stands out very plainly and that is that there is no standardization of practice in the matter of using coatings. Each company using coatings seems to follow no definite plan and many of them appear to be wasting money by continuing to use paints on the service pipe for protection against corrosion. This seems rather disheartening in view of the performance of paints shown by our A.G.A. tests. We should try to find out whether companies are giving our results on coating tests proper consideration in present and future policies, with reference to services, and if they are not, *why* not? Is it a matter of economics? Is it a matter of the lack of dissemination of information on coating performance, etc.? I think our committee, particularly, should be watchful to see whether the information Dr. Ewing is gathering is proving helpful to the distribution men or is only something to read about."

Editor's Note:—Dr. Ewing's work on pipe corrosion is well known to most technical men in the gas industry. His paper on "Corrosion Surveys for Transmission Lines and Distributions System," appearing as part of the A.G.A. Distribution Committee Report for 1934, contains a detailed discussion of soil corrosiveness and of the economics of using pipe coatings. It is somewhat mathematical, but should be obtained and read by all seriously interested in this subject.

The paper here reprinted deals largely with the failure of service pipes. The following quotation from the above mentioned "Corrosion Surveys" is of interest in this connection.

"Several months were spent on the properties of the Long Island Lighting Company and Public Service Electric & Gas Company of New Jersey. Soil samples were taken at places where corrosion failures had occurred, and the resistivity and acidity of these samples were determined. Some samples were also taken at places where pipes had lasted long periods without developing leaks.

"*Most of the corrosion failures were on service pipes.* Some steel mains had developed leaks, but they were usually small mains carrying high pressures or they were exposed to rather severe conditions. *No failures were observed on cast iron mains,* which usually carry low pressures. Isolated service failures were observed in soils with very high resistivity and low acidity. It was found, however, that if several failures had occurred in a small area, the soil either had a low resistivity or a high acidity, or both. These corrosive areas can, therefore, be easily and accurately outlined by measurement of acidity and resistivity."

If a pipe is mantained at a negative potential of 0.3 volts relative to the surrounding earth, corrosion is arrested. The author, in this very interesting paper, tells how this is done and how much it costs to do it.

4. A Review of Cathodic Protection of Pipe Lines

By A. F. BRIDGE

Southern Counties Gas Co. of California, Los Angeles, Calif.

DURING the past two years several papers have been written on the subject of cathodic protection of pipe lines against soil corrosion, in which the underlying theory has been fully presented.

Cathodic protection has been successfully employed in the Gulf Coastal section for several years, notably on the mains of the New Orleans Public Service Inc. and the Baton Rouge-New Orleans line of United Gas System. These pipe lines are located in soils where the water table is usually close to the ground surface, thus causing active corrosion of unprotected steel structures. The severity of corrosion, low soil resistivity, and, in some cases, the difficulty of obtaining a protective coating free from imperfections, in marshy country, have favored the adoption of electrical drainage, since it apparently provides a means of arresting corrosion.

In my opinion, the ultimate success, from an economic standpoint, of this method of protection will depend on the answers to certain fundamental questions, and apparently experience is as yet insufficient to provide definite answers to all of them. These questions are:

1. Does electrical drainage effectively prevent soil corrosion of metallic sub-structures?

2. Will the application of potential and resultant current flow shorten or prolong the useful life of pipe coatings?

3. Even though pipe coatings are unaffected by drainage, will their electrical resistance decline, due to water absorption or mechanical breakdown, until increasing energy costs make continued drainage prohibitive, and if so, how rapidly will it proceed?

There is ample evidence from a number of sources to answer question one definitely in the affirmative. Results reported by Messrs. Kuhn, Thayer, Schneider, and others, covering tests made in Louisiana, Texas, and California, show conclusively that if pipe is maintained at a negative potential of 0.3 volts or more relative to surrounding earth, corrosion is arrested.

> If a pipe is maintained at a negative potential of 0.3 volts relative to the surrounding earth, corrosion is arrested. The author, in this very interesting paper, tells how this is done and how much it costs to do it.

The evidence bearing on question two is somewhat incomplete and conflicting. Engineers who have had considerable experience with electrical drainage report that they have observed no damage to coatings on drained lines, which could be attributed to current flowing onto the pipe. In contrast to these reports are the results of a series of laboratory tests recently conducted in California by A. B. Allyne, in which the bond between bituminous coatings and steel was destroyed in from 22 to 82 days when embedded in water-saturated corrosive soil and with negative potentials of 1 to 4.3 volts maintained relative to the soil. These tests were reported at the 1934 annual meeting of the Pacific Coast Gas Association. The following conclusions are quoted:

"1. Asphaltic coatings appear to lose their bond rapidly in the vicinity of bare metal spots on a pipe buried in the soil. This applies when no electrical protection is used as well as when the samples were kept at 0.3, 1.0, and 4.3 volts below soil potential.

"2. Coal tar coatings lost their bond, within the limits of this series of tests, when the samples were kept at 4.3 volts and 1.0 volt below soil potential but did not behave in this manner when kept at 0.0 or 0.3 volts below soil potential.

"3. When the coated specimens were subjected to a potential of 4.3 volts and 1.0 volt below the soil potential, both asphalt and coal tar samples lost their bond, blistered or cracked, and were pushed from the metal surface.

"4. With the coal tar samples at 0.3 volts below the soil potential, there seemed to be no greater breakdown of the coating than occurred when no electrical drainage was used. With the asphalt samples, a slightly greater loss of bond occurred when they were held at 0.3 volts below soil potential than when no voltage was applied."

It should be noted that the specimens tested were partly bare, so that current density was relatively high on the exposed surface adjacent to the coating, and loss of bond proceeded progressively from this edge.

A preliminary conclusion from these tests is that if potential differences across coatings under drainage are limited to 0.3 volts, damage will not result. It appears possible to obtain the optimum design for drainage projects, covering a wide range of conditions, without exceeding 1 volt across the coating.

Pipe lines have been drained for several years with potentials as high as 2 volts across the coatings, without apparent damage. Pending the outcome of field tests we have assumed that potentials of 2 volts or less will not shorten the effective life of bituminous coatings on pipe lines. It should be noted in this connection that the coatings of the laboratory specimens did not include any wrapper, whereas many of the pipe lines now drained have rag or asbestos felt wrappers.

Considering next, question three—coating breakdown from natural causes—water absorption, cracking due to soil stress, loss of elasticity because of evaporation of volatile constituents, etc.

Whether the coating on a given line will not eventually disintegrate because of soil stress and/or evaporation of volatiles depends, of course, on the coating and the soil; however, certain bituminous coatings seem to retain their "life" or elasticity after long periods, and it has

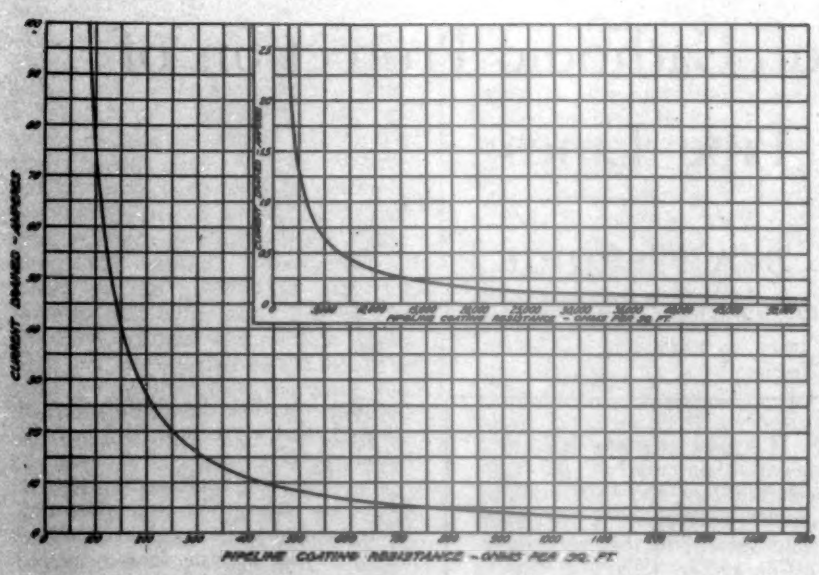


Chart 1. Graph showing current required to produce a 0.2 volt reduction in "pipe line to soil" potential at the extremity of 1 mile sections of 12¾ in. O.D. pipe line having various coating resistances.

been established that a wrapper of inorganic material affords considerable protection against destructive mechanical action by heavy soils. Furthermore, under some conditions the flow of current toward a cathodic pipe line gradually builds up a layer of salts surrounding the pipe, which may provide both mechanical and chemical protection.

To sum up, it is yet to be demonstrated that electrical drainage will defer reconditioning for an indefinitely long period and thus, correspondingly, prolong the useful coating life, but experience to date has been quite favorable, and it is my opinion that provided:

1. The coating is reasonably impervious to water, and
2. Soil stress is absent or coating adequately resists such action, and
3. The coating does not disintegrate due to inherent defects,

then drainage can be continued indefinitely without reconditioning, and corrosion will be eliminated.

The important items which govern annual per-mile cost of cathodic protection are:

1. Unit resistance of coating.
2. Cost of ground electrodes, which varies with soil resistivity and moisture content.
3. Unit cost of electric energy.

The resistance of pipe coatings varies over a tremendous range—from 10,000,000 ohms to 16 ohms per sq. ft., dependent on age and material. However, if we consider only hot bituminous applications, and exclude the initial figures before water absorption has occurred, and which are therefore of little practical importance, the variation is narrowed down to a range of say 50,000—300 ohms per sq. ft.

The drainage current necessary to maintain the minimum protective voltage across the coating is an inverse exponential function of the coating resistance, other factors being constant. Chart No. 1 shows total current input per mile of 12 in. pipe line in relation to coating resistance. Current input also varies directly with the potential difference across the coating at the extremities of the drained section, hence it is important to hold this to the least value which will prevent corrosion. Kuhn recommends 0.3 volts; laboratory tests by Corfield indicate that 0.1 volt is sufficient. We have tentatively adopted a minimum of 0.2 volts, which figure is used herein in estimating energy requirements and costs.

Table I and Chart No. 2 show the variation of annual drainage costs per mile of 12 in. main, with coating resistance. These are derived in part from the current-resistance relation of Chart No. 1, which accounts for the steepness of the cost curves.

While Table I and Chart No. 2 have been developed from actual experience under conditions prevailing in Southern California, the relation derived should be generally applicable. Each point plotted represents over-all annual costs for the most economical project designed to maintain the required potential across a coating of the given unit resistance. In order to simplify the graph the number of variables has been minimized.

Pipe line—12¾ in. O.D., 34 lbs. per ft.

Ground Electrodes

Multiple units consisting of 15 ft. of 6⅝ in. pipe (scrap material) buried vertically, spacing 20 ft.

Resistance per electrode—1.5 ohms (anodic conditions).

Metal loss—5 lbs. per ampere per year.*

* Depreciation of electrodes at this rate, or cost of metal loss, whichever is the greater, is used. This annual loss of anode metal is based on experience and is 25% of the theoretical value.

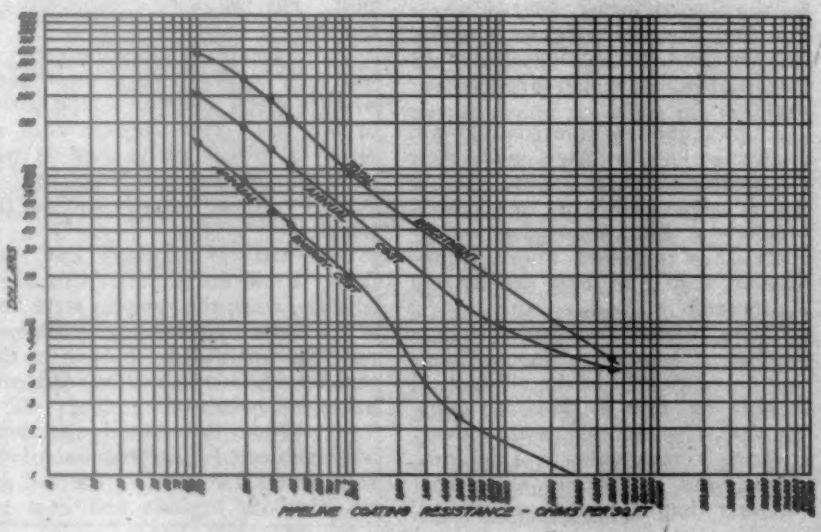


Chart 2. Investment and annual operating expenses per mile for cathodic protection of 12¾ in. pipe line. Total length 38 miles.

TABLE I

ESTIMATED MINIMUM COST FOR CATHODIC PROTECTION OF 38 MILES OF 12¾" PIPE LINE WITH VARIOUS COATING RESISTANCES

Assumptions: Over-all station efficiency=50%; minimum reduction of "pipe to soil" potential due to draining=0.2 volts; stations are equidistant.

Data for Entire Line							
Resistance of Coating, ohms per sq. ft.	*100*	*200*	*300*	*400*	*1,000*	*5,000*	*50,000*
Total length of pipe line protected—37.8 miles							
Total number of drainage stations	35	20	16	15	10	4	2
Spacing of drainage stations—miles	1.08	1.89	2.36	2.52	3.78	9.46	18.9
Yearly total cost—Dollars	12,240	6,980	4,940	4,005	1,959	539	187
Yearly total cost per mile—Dollars	324	185	131	106	52	14	5
Total investment—Dollars	25,400	14,460	10,800	8,130	3,515	1,046	216
Total investment per mile—Dollars	672	382	285	215	93	28	6
Per Station							
Current drained—Amperes	45.1	44.7	35.7	28.50	16.9	9.42	1.48
"Pipe to soil" potential at drain point—Volts	0.6	0.49	0.48	0.45	0.43	0.51	0.30
Number of 6"x15' vertical iron ground electrodes, spaced 20' apart.	15	15	15	10	5	5	1
Total resistance of ground connection—Ohms	0.25	0.25	0.25	0.33	0.52	0.52	1.5
"Ground electrode to soil" potential—Volts	11.4	11.4	9.1	9.40	8.81	4.90	2.22
Potential across rectifier terminals—Volts	12.0	11.9	9.6	9.85	9.24	5.41	2.52
Rating of rectifier, D. C.—Watts	541	532	342	281	157	50.9	3.7
Power required, A. C.—Watts	1,082	1,064	684	562	314	102	7.4
Energy used per month—Kw. Hr.	780	777	499	411	229	74	5.4
Energy cost per month—Dollars	13.00	13.00	10.20	9.25	6.20	3.10	1.25 (Min. Chg.)
Average rate—Cents per Kw. Hr.	1.68	1.68	2.05	2.25	2.71	4.19	
Energy cost per year—Dollars	156.00	156.00	122.00	110.70	74.50	27.20	15.00
Cost of rectifier—Dollars	335.00	333.00	285.00	265.00	200.00	110.00	40.00
Cost of ground electrodes—Dollars	390.00	390.00	390.00	277.00	151.50	151.50	68.00
Total investment per station—Dollars	725.00	723.00	675.00	542.00	351.50	261.50	108.00
Yearly total fixed costs—Dollars	117.50	117.00	109.30	87.80	56.80	42.30	17.50
Yearly rectifier maintenance expense—Dollars	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Yearly ground electrode maintenance expense—Dollars	16.00	16.00	16.00	8.50	4.62	5.32	1.06
Yearly rectifier operating expense—Dollars	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Yearly total cost per station—Dollars	349.50	349.00	308.00	267.00	195.92	134.82	93.56
Yearly total energy cost per mile—Dollars	144.50	82.50	51.70	43.80	19.70	2.40	.79

Coating Resistance

Varying from 100-50,000 ohms per sq ft.

Minimum negative potential maintained to ground at extremities of drained section = 0.2 volts; maximum at drain points = 1 volt.

Fixed Charges

Interest 7%.

Depreciation 7.6% (10 year life of equipment except electrodes).*

Energy Cost

As per general power schedule (blocked load factor rate) effective throughout Southern California. This schedule is similar in form to those applicable in many other sections of the country although somewhat lower than most. The rate varies from 4.2c to 1,7c per kw.hr. for the monthly usage included in this study. If a straight rate per kw. hr., regardless of consumption, were used, the results would be misleading, as such power schedules are very rare.

Energy Source

220 volts A.C., converted by copper oxide rectifies with over-all efficiency of 50%.

Conclusion

A brief summary of the present status of cathodic protection follows:

1. It has been demonstrated beyond question that a negative potential of 0.2 volts (net) pipe to soil will effectively prevent corrosion. There is also some evidence which indicates that negative voltage of *any* magnitude will suffice.

2. Laboratory tests show that negative potentials exceeding 1 volt cause loss of bond between pipe metal and thin bituminous coatings, when adjacent metal is bare. Actual drainage experience indicates that this action, if present at all under field conditions, does not impair coating resistance; furthermore, drainage projects can be economically designed for a wide range of conditions without exceeding 1 volt across the coating.

3. Unit electrical resistance of bituminous coatings in general use varies widely with age and porosity, and this variable is by far the most important factor influencing the cost of cathodic protection. Thus resistances of such coatings several years after installation on one gas system range from 134 to 16,000 ohms per sq. ft., and corresponding annual costs of drainage are $250 per mile and $7 per mile respectively.

4. Ultimate economic success of cathodic protection projects frequently depends on preventing *continued* deterioration of coating after drainage is applied. Experience to date indicates that for coatings several years old when drainage is started and which have therefore reached equilibrium in water absorption, deterioration is arrested by drainage. This opinion is based on observation of coating resistance. The information on this important point is quite meager as yet, and therefore inconclusive.

5. Provided the tentative conclusion in 4 above is correct, cathodic protection of lines traversing corrosive soils will often effect very handsome savings over the alternative program of coating repair and renewal.

Internal Corrosion of Natural Gas Transmission Lines

(*Continued from page* 28)

means for the removal of this sulphur from the scrubber must be provided. Further development along this line may be profitable.

The consensus at present appears to be that the most economical way of preventing internal corrosion of many natural gas transmission lines is by dehydration of the gas entering the lines. This opinion seems to be warranted by the manifold advantages that are obtained by dehydration, and by the very low costs of dehydration that are made possible by good engineering. It might be pointed out in this connection that many long transmission lines serve to dehydrate the gas automatically.

The problem presented by the internal corrosion of pipe lines is complex, but can be solved by the application of known principles of engineering, chemistry, and economics. It offers an excellent opportunity for cooperative research.

Try Billboard Proportions In Your Window Displays

By STUART BRATESMAN
Manager, Display Department, Boston Consolidated Gas Co.

IN a medium of advertising like window display, efforts are continually being made to vary the treatment of each design. Because of their similarity to outdoor billboards, effective window displays can be created in the long proportions generally associated with the larger medium. By eliminating the appliance and supporting the actual design with plywood, monks cloth and silver half round areas, the effect of a third-dimension outdoor poster can be simulated in the window.

Two examples of window displays designed and constructed along these lines are shown on this page. They differ, both in appearance and construction, from the type of window set usually used by departments producing poster material in the gas industry, today. The effect desired is merely a supported billboard design, sans appliance, in the window, instead of on the boards.

It can be readily seen that, to use these long type designs in your windows over a long period, would create a rather monotonous impression, but, used occasionally in groups of adjacent windows, the activity serves as a nice break from the regular sets.

Windows are basically advertising space in third-dimension. Obviously, we should treat them as such, not as flat media, but a change to this type of long design should not hurt their effectiveness, providing all the elements combine to sell sales and promotional messages quickly and effectively. The absence of the appliance might be questioned by some company officials, but in a case like this it is justified, as there is no room for it in the set-up.

In outdoor advertising, the splash is the thing. Instant legibility and a colorful layout, combined with a strong and appealing illustration will "get" the story to the public, at a glance. Unsuccessful attempts have been made to include more than a few key lines in billboard design, but the posters lost effectiveness. One thought, well presented, is worth more than a hundred uninteresting "facts" about the subject. We can use this same type of simple design in gas company windows. Transposed to the third-dimension space, in flat area form, the treatment car-

(Continued on page 58)

"SUCCESSFUL SELLING"

Using Advertising Effectively to Increase Gas Consumption

By WILLIAM E. LEVERETTE

Commercial Manager, Nashville Gas & Heating Company, Nashville, Tenn.

THOSE of us who have watched the fuel and general public utility market for the past ten years do not find anything particularly new in the TVA yardstick. Electric competition has been gradually slipping up on us and about all we have done is to sit around reading papers and listening to talks on the wherebys and who fors of electric competition, with nothing actually being done.

It is my opinion that this sudden and probably uneconomical jolt of electric rates will affect us rather rapidly in climaxing our sales efforts, and at the end, we may come out far better than we expect. To say the least this government sponsored and direct competition may prove to be our own yardstick as to continued existence.

We firmly and enthusiastically know that GAS is the superior fuel for purposes that we recommend, and our greatest means of attack is to attempt to transmit our knowledge to the general public. It is not necessary to go into a lot of detail regarding gas and its merit, but we may be able to give a few advertising methods we use. The sales arguments used in person are elaborations of our advertising campaigns.

As to actual ultimate results, no one can see, however, at the moment it is quite apparent that we are the ones carrying the ball. We are on the five-yard line with no downs. Naturally we expect the opposition to strengthen their lines and run in a few reserves.

At the moment we are adding customers, whereas in the past, during the fall months we lost a considerable number of users due to seasonable conditions.

What ever success we are now enjoying we can attribute to several conditions as there is no individual or group responsible. We will enumerate these conditions as follows:

1—A reduction in rates, by far the most important.

2—A gradual workable dealer relation set up that deals with sales and whole-hearted assistance rather than a lot of engraved booklets and systematic rot that can go for nil if not exercised.

3—An expenditure for complete remodeling and modernizing our offices and displays.

4—An age of gas appliances that are the most up to the minute possible, at prices far below prevailing competition, with inherent quality, not available in other than gas. Personally, I think the manufacturers have done a beautiful job, and this has been done without government dictation.

5—The extreme pleasure of working with a company that has no "canned" rules and restrictions that completely retard rapid analyzing of immediate situations, and acting.

To some, this last reason may appear humorous, or there might be a question as to where it fits into TVA competition. The answer is: "Its importance is second only to rate structure."

The writer has been in Nashville seven months and can cover only incidents from that time on. He has had the distinct advantage of coming in when the time was right to adjust rates and other conditions to meet the evident situation. All things we have done were already known and it was merely a matter of someone to carry on that which was in progress.

We found that the electric rates had been reduced to a point where we were in a definite line of losing our choice business and because of a service charge and high initial rates, our low income busi-

New Offices of Nashville Gas & Heating Company—Note New Gas Lights

ness would have scattered to oil, coal, wood, and electricity.

Thirty dealers other than straight electric, radio and refrigeration, were pushing electric ranges and some of these electric water heaters. We were the only firm in the entire city selling gas appliances. Such a general reaction to the public was felt very strongly. Conversation and sentiment pointed to electric because of pronounced government sponsored press publicity. Dealers reasoned that GAS was a back number and here was a new sales outlet with the possibilities of radio or the automatic refrigerator. These same dealers, like those in a lot of other cities felt that they had been mistreated by the Gas Company. Frankly, I think in some instances they had. We admitted our faults and then pointed out that their ears were not completely clean. We sat around tables, discussed each other's problems, found out that they did not like the unprofitable TVA set up of electric merchandise, and, how we could best serve them.

Dealer Salesmen Bonus

We found the electric company offering a bonus to dealer salesmen for ranges and water heaters, free installation and one or two other conditions. In turn, we now pay the bonus and install or connect dealer merchandise (modern type only) free of charge and service in the same manner as our own. This move has proven profitable rather than an expense as 25% of dealer sales are new customers, plus, we do not know how many customers we have saved. Today we have thirty dealers, including one that was all electric, who, to say the least do not openly knock us.

Dealer "Proof" Demonstrations

We held demonstrations for these dealers and their salesmen showing the merits of GAS, such as rubbing clean rags on a cooking pot, waterless and whole meal cooking, little shrinkage and the other sales "phonies" claimed by the electric manufacturers, plus the real practical merits of GAS.

The day we announced our new low rates we had all the dealers lined up and instead of just announcing a rate, both papers ran special eight (8) page sections with our story and ads, and the same about the dealers.

Usual "Ad" Mediums

We also used the usual billboards, radio, direct mail, and other forms of known and proven worth. We believe when we finished the general public felt that GAS was not giving way so easily and that our rates were always going to be balanced.

Rentals Not Necessary

We have not found unusually long terms necessary. TVA quotes 36 months, we use only 24. In fact we tie in with prices, terms, etc., as are considered economically sound by individual dealers. Dealers carry their own stock and papers. On very rare occasions we carry a long term paper for a dealer who has a customer rigidly sold on equivalent to TVA terms.

As is generally known, these TVA terms were questioned in many ways by dealers throughout this section and we found this one of the main unpopular points to attack.

Display Floor of Nashville Gas & Heating Company

Satisfy them all!
"HEY! why don't we ever have any hot water around here?"
Now Hot Water at a New Low Cost
$49.50
Associated Master Plumbers

Sales Program

Since the announcement of the new low rates, our sales program has been general rather than special sales or campaigns with the exception of a definite attempt to reconnect old customers that we had lost through economic conditions or because of the previous rate structure.

Reconnect Free Campaign

We announced in several forms that we would reconnect, adjust and clean old appliances free of charge and would connect and service new (modern type) appliances if purchased from local dealers. We also announced a refinancing of old bills for delinquent and cut off customers. If these were not good moral risks, we required a good deposit which usually automatically discouraged them.

The results of this campaign plus other promotional efforts caused a good number of customers to return to gas from all classes of fuels. We then started a 2x4 daily ad on the amusement page of both papers reading as follows: "Yesterday, 21 customers changed to gas, 378 have changed since we announced our

new low rates." The figures were changed daily to whatever number added. This little campaign caused more comment than any others.

Old Stove Campaign

We conducted the much used old stove campaign, offering a new range for the oldest in use. This was not done to secure prospects, but to prove an over-all economy in gas cooking. Over three hundred entries were sent in, averaging 29 years, service cost less than one dollar each per life, with 70% no service cost at all. The oldest range was 44 years old, had cooked 231,000 meals, cost of range $20.00, service 75c for its life and an average gas bill of $2.75 per month or less than 5 mills per meal per person. It is needless to say that this campaign has helped us a good deal in arguing and showing conclusive proof of economy.

The Story of Time Saving

So much has been said by the electric company about automatic clocks, etc. Instead of defending gas by offering such, we openly state they are available, but women continue "to be funny" by cooking in the kitchen. They do not cook on the golf course, or at a bridge table; however, they get behind at these functions and when they arrive home late, they want real speed to catch up. In other words GAS is a real time saver and not an instrument to tell true but impractical fairy tales about.

Better and Healthier Foods

We have ridiculed this plain malicious statement by stating in ads and otherwise that taste depends on the cook and health on selection and preparation plus balance and method of consumption by the individual.

99% Use Gas Ad

Whether it is one of Nashville's finer restaurants or hotels $2.00 table d' hote, or a delicious 5c hamburger and coffee at a pie wagon, 99% use GAS. Ask them why? This ad was used with dining effects in both instances. "Authorities on cooking agree" series:

The Chef (With animation)

The chef in a hotel, famous for its savory, tasty foods, knows from experience that to meet the multitudinous and varying demands of critical patrons, he must use a flexible fuel . . . one that meets the demand for speed. He must maintain cleanliness and keep down fuel cost. He chooses GAS, for only gas measures up fully to his exacting needs.

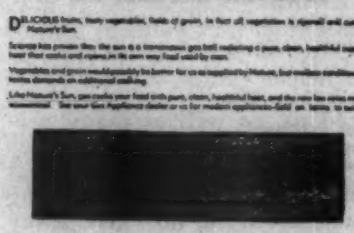
"Mammy" (With animation)

Who does not revel in the delightful foods prepared by the old-time Southern mammy! And who will question her testimony that no other equals GAS for giving just the right cooking temperature to bring to perfection the delicate flavors which are the delight of her cookery . . . for quickly preparing the hasty lunches asked for by young and old in the "big house."

"The Housewife" (With animation)

And the modern housewife who does her own cooking—who must arrange her housework to permit recreation and social contacts and keep expenses within the family budget. She uses GAS because it starts instantly and stops when cut off . . . because she can regulate it easily to exactly the heat she wants . . . and because it saves her time and money and because the modern gas ranges are the world's most beautiful.

When Mother Nature ripens her food *she uses* Gas



Nature's Own Fuel

A series of ads somewhat as follows:

1—The sun shining down on Mother Earth with the heading: "When Mother Nature selected a fuel she chose GAS." A brief explanation of the burning gas of the sun.

2—The sun shining on a field of grain with the heading: "When Mother Nature ripens her food she uses GAS."

3—The sun shining on an apparent coal mine (can be changed to natural gas field) with the heading: "Thousands of years ago Mother Nature began storing the heat from the sun etc." We dig this condensed heat (coal), transform back to fuel, clean and purify and serve to our customers.

(Continued on page 58)

1035 Water Heaters Sold in 43 Days

By H. M. BRUNDAGE, JR.

General Sales Manager, Washington Gas Light Co.

With a fair quota of 448 Automatic Water Heaters for the "43 working-day" period from September 5 through October 27, 1934, the New Business Department of the Washington Gas Light Company ended an "off-season" fall campaign with a total of 1035 contracts signed.

I have been asked what ideal contributing factors made possible such a landslide—an increase of more than 300% over quota. In the beginning let me state that the original figure of 448 expected sales was not a quota which could be considered over conservative. Indeed, in light of a total of 170 sales for the same period last year, and a total of 525 sales during a six-week campaign in the spring, the accepted seasonal time for sales of this appliance, the quota for our Fall Campaign seemed rather high. And but for the fact that the campaign was carefully supervised in all of its stages, and additional tactics employed after its beginning, the final results would have amazed us, as well as many people who since have been at a loss to understand just how this was accomplished. There is nothing unusual about it, no "give away terms," no allowances for old equipment, no trial offers, or deferred payment plan—just a desire on the part of hard-working salesmen to make money and machinery which was set up to make it both profitable and interesting for these men to sell. Although newspaper advertising announced a manufacturers price reduction and a slightly added reduction of our own, prices on the merchandise were still comparatively high. How, in the face of these conditions, was the astounding total of 1035 heaters in 43 days made? We will start at the beginning of the Campaign.

Trans-Continental Airplane Race

On the morning of September 5, the 14 members of the Range and Water Heater Division were assembled by A. J. Maloney, Supervisor, for a brief review of the activities of the department to that point and to announce, in percentages, the increase in earnings this year over last year for each individual salesman and to prepare them for the final effort on Water Heaters for the current year. The essence of the saying, "nothing succeeds like success," evidently had taken firm root in the minds of these salesmen for they responded with enthusiasm to a "Trans-Continental Airplane Race" outlined by J. D. Dingwell, Assistant General Sales Manager, as the basis by which their efforts would be judged for the entire length of the drive. Following unveiling of a brightly colored map of the United States painted by our company artist on wall board, 14 planes, also cut out of wall board, were lined up at a place designated on the map as Washington Airport and headed over a route which, when circled, would bring each plane to the Atlantic City Airport for a three-day visit to the American Gas Association Convention October 29 to October 31. Along the route, which was marked off by colored tape, were markers representing a certain amount of sales and at each quarter of the way around were placed pylons marking a turn in the course to the next lap. To reach Atlantic City and to gain the honor of representing their company at the A.G.A. Convention each salesman had to make an individual quota. The fuel used to carry these planes aloft, as stated above, was water heater orders and the money to purchase this fuel was hard, intelligent work. The more work the more fuel, and the more fuel the faster each individual plane sped through the clouds to its destination.

Harris & Ewing

Salesmen of Washington Gas Light Co., who won awards

A. G. A. Convention Goal

As an added incentive not only to make quota but to exceed it the salesman were told that in addition to a round trip ticket to Atlantic City, for two sales over quota they would receive their round trip tickets plus Pullman; for seven sales over quota they would receive their round trip tickets plus Pullman fare, plus expenses for their hotel room for the entire three days at the convention. For 12 sales over quota they would receive a round trip ticket, Pullman fare plus hotel room, plus all meals for the entire three days.

Beyond being intensely interesting to the salesmen, the contest, with the colored map, made it possible at a glance for each salesman to see immediately how he stood with other members of the department and incited more-than-ordinary competition among men in

evenly matched territories. As the sale progressed it was decided to offer in addition to other prizes an extra bonus of $3.00 for each sale over the ones quoted above to spur efforts to earn money for incidental expenses in their trip to Convention City.

Newspaper advertising stressed $2.50 down and the average purchase cost per day of an Automatic Gas Water Heater figured on monthly payments. The story was further broadcast in spot announcements daily in the "Sun Dial" Program, a morning variety program conducted by an exceptionally popular local announcer, and the distribution of 65,000 brightly colored folders to Washington homes.

Modernizing Movement

Although the extensive publicity given water heaters during the drive resulted in getting many prospects and increasing business on the company's sales floor, constant canvassing by salesmen in the field swelled the total day by day, at a rapid rate. Modernizing movements naturally afforded a stimulus, although the effects of the Federal Housing Act and its application to home owners for home improvements had not fully begun to make headway.

As the sale progressed, increased friendly competition developed between salesmen of different territories and it was decided that since a similar drive on Automatic Gas Heating Plants was being made for the same length of time in the "house-heating and Refrigeration Division" by the same number of men in almost identical territories, another competitive situation could be developed. The captain of the Water Heater group challenged the House Heating group for possession of a silver loving cup donated by the company to repose in the department of the winning team. The challenge was accepted and both departments were matched on a percentage basis. This meant that if the Water Heater Department during their drive made 100% of quota and the House Heating Department during the drive for House Heating Plants made only 96% of quota the loving cup would be awarded the Water Heater group. Both departments were urged to base as many prospects as possible on the other department's appliance, and even though by so doing it would increase the opposite department's march toward the loving cup, the amounts of money paid on prospect basings for the salesmen in the competing departments were increased which provided an incentive to make more money.

At the end of the drive, although the House Heating Department exceeded its quota by a substantial degree, the momentum gained on water heaters had assured the Water Heater Department an easy victory. As a matter of fact so much momentum was gained that the small planes representing the individual salesmen on the previously mentioned chart circled the course twice and many salesmen pilots took additional "pleasure jaunts" down the Atlantic Coast and back before finally bringing their planes down at Atlantic City. Individual records established by the eight leading salesmen at the end of the campaign were as follows:

105	sales	L. E. Campbell
88	sales	F. W. Bond
81	sales	N. S. Stinchcomb
80	sales	R. A. Fennell
78	sales	P. V. Hilton
77	sales	C. T. Stockdale
71	sales	W. E. Hall and M. B. Kammerer

It is interesting to note that every man in the department earned the opportunity to attend the A. G. A. Convention, and in addition to achieving this honor and obtaining the silver loving cup for his department, was able to substantially increase his earnings over an already-increased total of earnings for the year to the date of the campaign.

Secret of Success

The secret of such a campaign, if there is a secret, can be summed up in—a good product, satisfactory working conditions for those who do the job, the provision of adequate opportunity for making money in the sales profession, proper selection of salesmen who are willing to work, and sympathetic and interested supervision by the management of the company who employs them.

1934 "World Series"

W. M. Walsh, Merchandising Manager, The Connecticut Light & Power Co., Hartford, Conn., sends the following plan: which was prepared for distribution to district offices and sale organizations, and final results of their recent gas range campaign.

The Market

Gas Cooking, long recognized as the best method of preparing food is now more popular than ever due largely to two important factors:

First—the greater efficiency, improved design and lower price of the modern gas range.

Second—lower gas rates and higher costs of competitive, but less perfect cooking fuels.

Gas Range Manufacturers have outdone themselves this year in building ranges more beautiful than ever before, incorporating such features as Automatic Lighting, Automatic Oven Heat Control, Automatic Clock Control, Heavier Insulation, New Quicktop Burners, Easy Rolling Utensil Drawers, Hinged Covers easy to lift and Convenient Drawer Broilers. There is a wide range of colors to select from so that the housewife can choose a range to match the color scheme of her kitchen. Yet in spite of all these improvements, the new prices are lower than any type of range of similar quality and utility on the market today.

Each of us knows that there are hundreds of housewives in our territory who are contemplating disposing of their old cooking equipment at the earliest possible date.

Under the lower gas rates now in effect we can show these prospects how, with a modern gas range, they can save enough on their cooking costs in a short period to more than pay for the new range.

We have everything to go out and do a larger fall business on Gas Ranges this year than we have done for many past years. Let's capitalize the advantages that are ours to make this Campaign an outstanding success, thereby increasing the Gas Load for the Company and reaping rewards in greater profits for ourselves.

Product

Our regular line of Quality Gas Ranges will be featured during this Campaign and special prices have been established on the following models:

Model	Type	Equipment	Regular Cash Retail	Special Cash Retail	Time Price	Payments Initial	Payments Mo.
2802	Console	Automatic Top and Oven Lighters	$98.50	$89.50	$98.50	$5.00	$5.00
2017	Table Top...	Rutzomatic Top Lighter	64.50	59.50	64.00	5.00	5.00
3400	Console	Rutzomatic Top Lighter	67.50	62.50	67.00	5.00	5.00
1700	Table Top...	Safe-T-Top Lighter.	93.50	84.50	93.00	5.00	5.00
9300	Combination.	With Gas Burner (16" Oven) ..... (*allowance $10*)	149.50	139.50			
				12 Mo.	150.00	5.00	12.00
				18 Mo.	154.00	5.00	8.50
				24 Mo.	158.00	5.00	6.50
				30 Mo.	162.00	5.00	5.00
9100	Combination.	With Gas Burner (18" Oven) ..... (*allowance $10*)	162.50	152.50			
				12 Mo.	165.00	5.00	13.00
				18 Mo.	169.00	5.00	9.00
				24 Mo.	173.00	5.00	7.00
				30 Mo.	177.00	5.00	5.75

Includes $10 Allowance.
All other models $5.00 down, balance payable within 18 months with a minimum monthly payment of $3.00.

1934 Gas Range Activity World Series

To carry out the baseball theme used in the Gas Water Heater Sales Activity to its logical conclusion, it is planned to conduct a World Series in connection with our September Gas Range Campaign. The American League will play a series of six games—one game each week—with the National League, to decide which league is the champion. The league scoring the higher percentage of its quota each week will be adjudged the winner of the game for that particular week.

Each of the teams in the winning league will be awarded a cash prize at the conclusion of the Series and one cash prize will be awarded the team which makes the best showing in the losing league.

This Series will give some of those teams which found it slow going in the Gas Water Heater Activity, an opportunity to redeem themselves by helping the other teams in their respective league to carry off the honors.

It will be noted that the sales quota for each league is identical. At the conclusion of the Series cash prizes will be awarded for the outstanding players in both leagues.

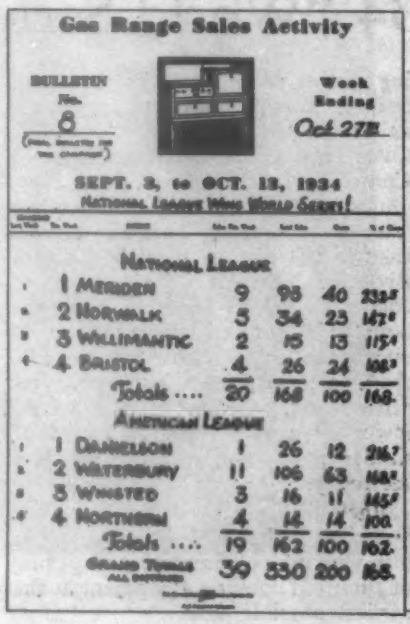
Quotas

American League		*National League*	
Winsted	11	Norwalk	23
Danielson ...	12	Meriden	40
Waterbury ..	63	Willimantic	13
Northern ...	14	Bristol	24
	100		100

Total Quota—200 Units

Campaign Prizes

1. $20.00 will be awarded to the team in the winning league which makes the best showing, (that is, the district which scores the biggest percentage of its quota).
2. $15.00 will be awarded to the team in the winning league which makes the second best showing, (that is, to the district in that league which secures the second highest percentage of its total quota).
3. Prize of $10.00 will be awarded to the third team in the winning league.
4. A prize of $5.00 will be awarded to the fourth team in the winning league.
5. A prize of $15.00 will be awarded to the team in the losing league which has made the best showing in that league, (that is, the district in that league which secures the highest percentage of its quota).


Gas Range Sales Activity

BULLETIN No. 8

Week Ending Oct. 27th

SEPT. 3, to OCT. 13, 1934

NATIONAL LEAGUE WINS WORLD SERIES!

NATIONAL LEAGUE					
1	MERIDEN	9	95	40	237.5
2	NORWALK	5	34	23	147.8
3	WILLIMANTIC	2	15	13	115.4
4	BRISTOL	4	26	24	108.3
	Totals	20	168	100	168.
AMERICAN LEAGUE					
1	DANIELSON	1	26	12	216.7
2	WATERBURY	11	106	63	168.2
3	WINSTED	3	16	11	145.5
4	NORTHERN	4	14	14	100.
	Totals	19	162	100	162.
	GRAND TOTALS ALL DISTRICTS	39	330	200	165.

Players' Prizes

1. A cash prize of $15.00 will be paid to the outstanding player in the Series, regardless of league (that is, to the salesman who sells the greatest number of units during the campaign).
2. A cash prize of $10.00 will be paid to the player who makes the second best showing in the Series.
3. A prize of $7.50 will be paid to the player who makes the third best showing in the Series.
4. A cash prize of $10.00 will be paid to the catcher from either league who makes the best showing during the Series (catcher will represent only floor salesmen).
5. A cash prize of $5.00 will be paid to the player having the best fielding average (that is, the salesman with highest average cash retail price). To compete, a salesman must have five or more sales to his credit.

The combined sale of a gas range and automatic water heater will equal a home run and a cash prize of $7.50 will be paid a player for every home run record. Water heater must be new installation and not a rental conversion.

Dealer Plans

The direct mail broadside and all newspaper advertising copy will call attention to the fact that local dealers are displaying new and modern gas ranges. It is not our intention to encourage dealers to promote the sale of the ranges that we handle, but rather to be more active in the field featuring the ranges they now carry.

We have two plans available for dealers wishing to sell the ranges we are carrying in our displays. Our advertising will bring customers to the dealer's store inquiring for a particular make. Our cooperative plans provide a substantial discount on these ranges—the amount of discount graduated in accordance with the dealer's display of approved gas ranges.

It is suggested that the districts forward a copy of our broadside to all local gas range dealers and encourage them to arrange for attractive window and floor displays during the next several weeks.

Broadsides

45,000 broadsides are being mailed to gas range prospects throughout our territory early in September. These broadsides feature the No. 2802 Quality Range at a special cash price of $89.50. They are printed in two colors, are very attractive and should greatly assist in stimulating gas range business during the period of the campaign.

Press Advertising

A series of newspaper ads have been prepared for use during the campaign and all districts will be supplied with copy, layout and insertion schedules each week.

Window Displays

Attractive window displays should be arranged on Gas Ranges during the campaign featuring the new improvements incorporated in the latest models. As this is canning season it would be timely to feature oven canning in at least one of your displays. Appropriate cards should be included in all window and floor displays to help tell the story you wish your display to put over.

Floor Displays

Attractive beaver board floor displays are being built for displaying the Quality All-Season All-Gas Range with E-Z Lite Burner and these will be available late in September.

Weekly Reports

The districts will be supplied with report forms on which they shall report the weekly sales. The forms should be mailed in time to assure delivery to Hartford so the Staff will have them each Monday morning during the campaign.

Weekly Bulletins

From the weekly reports sent to Hartford by the districts, the Staff will make up a Weekly Bulletin which will show the progress of the campaign as has been customary in other activities.

Employees Cooperation

It is expected that among other district efforts to make this campaign successful the cooperation of district employees will be enlisted. Employees might well pass along some information to their friends about the activity and the value of the merchandise our Company offers to its customers.

Results

Due to a tie game between the district groups it was necessary to extend the Campaign two weeks. Final scores are reproduced on Bulletin No. 8 herewith.

Fall -- A Productive Sales Period

By Edward J. Sullivan

Lowell Gas Light Company, Lowell, Mass.

The 1934 Fall Appliance Sale of the Lowell Gas Light Company was one we consider eligible to be classified under "Successful Selling," for its results were particularly gratifying.

The Fall season affords great sales possibilities to the Merchandising Department of a gas company! Vacations are over, men are returning to their work with renewed vigor, children are starting back to school, housewives are settling down to their work. In brief, summer has ended and once again the home and its requirements are the center of attention. Old wants are revived, and new desires are created.

To secure a maximum merchandise business, to retain and augment our gas load, we decided to have an all-appliance sale this Fall.

Thus, at a breakfast meeting, attended by the executives and sales staff, plans for this sale were outlined. Although this campaign, which was to last from September 18th to November 30th, featured ranges, kitchen range burners, automatic water heaters, refrigerators, and coke, primary sales effort was focused on ranges.

The following quotas were set: Ranges, 125; Kitchen Range Burners, 40; Automatic Water Heaters, 75; Refrigerators, 50.

To stimulate the sales force, and ensure a sustained enthusiasm and competitive spirit, a $20.00 prize was offered for the best all-round selling job of listed appliances, and a $10.00 prize was made available to all salesmen for good all-round selling jobs of listed appliances. A large, visual record of the salesmen's daily sales was conspicuously located in the District Salesmen's Room.

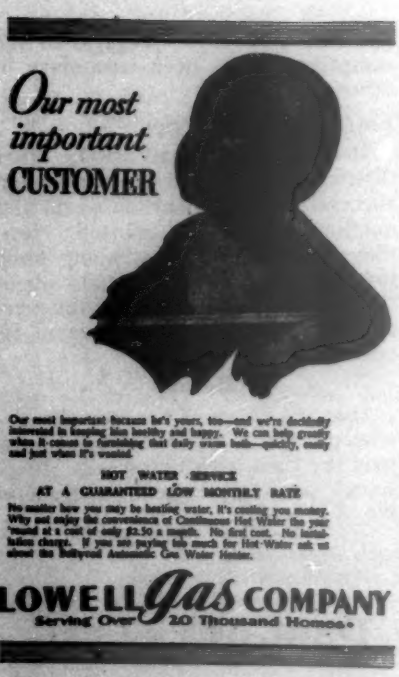
The promotional effort, sales methods and technique, and results naturally varied with the type of appliance sold.

In previous years, our Fall Range Sale consisted of a "special" for the month of November. This past Fall, however, range sales were emphasized throughout the entire season for three reasons. First, the Glenwood Range Company brought out a new, modishly designed, table-top model range, a beautiful range embodying all that was good in modern gas cookery; second, since metropolitan Boston was conducting a range sale on this model at a special price, it was felt that by co-ordinating our program with theirs we could capitalize on the tremendous publicity given this sale range; third, we knew from experience that there was a demand for this style of range, because our "1934 January-February Range Sale" clearly indicated that there is a decided trend toward table-top models in Lowell.

This range, whose regular price was $89.00, sold in Lowell and throughout New England for $69.00, less $6.90 for the customer's old range, making a net price of $62.10. The allowance was accepted as first payment.

Cooking Classes

Realizing the inestimable value of cooking schools, we influenced the two leading newspapers of Lowell to sponsor such classes, which were conducted by well-known home economists. During each school, which lasted four days, one of the


Our most important CUSTOMER
Our most important because he's yours, too—and we're decidedly interested in keeping him healthy and happy. We can help greatly when it comes to furnishing that daily warm bath—quickly, easily and just when it's wanted.
HOT WATER SERVICE
AT A GUARANTEED LOW MONTHLY RATE
No matter how you may be heating water, it's costing you money. Why not enjoy the convenience of Continuous Hot Water the year 'round at a cost of only $2.50 a month. No first cost. No installation charge. If you are paying this much for Hot Water ask us about the Ballyrod Automatic Gas Water Heater.
LOWELL Gas COMPANY
Serving Over 20 Thousand Homes

sale ranges was given away as a prize. At the first session, a range display was set up in the lobby of the hall; however, we observed that little attention was given to it, for the women were either interested in finding a seat or hurrying to leave the hall. At the second school, we changed our promotional policy. Instead of the display, three thousand broadside circulars were personally handed the women as they entered the hall for the last class. This was effective for the women could leisurely see and read about the range, its price, terms, etc.; they could talk about its features to their friends at the school; they could carry the booklet home to impress upon the rest of the family that this was the time to purchase this high quality range at an exceedingly low price.

Lowell's newspaper advertising corresponded to that of Boston—the same "mats" were used when possible, and the insertions occurred at approximately the same times. Although emphasis was placed on the exceptional quality of the range, the main advertisement appeal was economy. Several of the approaches were: "Gas Range for Limited Budgets"; "Save More Than 25%—Buy During Our Great Range Sale"; "200 Greater Lowell Families Can Save $5380—You Can Save $26.90"; "See it at The Cooking School."

Over Station WLLH of Lowell, Jane Deering, Radio Director of the Lowell Gas Company, frequently impressed her listeners that we were offering a real bargain on a range that would make cooking a pleasure.

In addition to the newspaper and radio advertisements, door "stuffers" were delivered from house to house by Boy Scouts hired for that purpose, and four thousand broadsides were delivered to a selected list of prospects.

The results of the range sale were very pleasing! With 226 ranges sold, we exceeded our quota by 80%. We cannot say that the quota was pessimistic, for it must be remembered that in January and February of 1934, we conducted our regular, major range sale. On the other hand, it is believed that the co-ordination of programs throughout New England, the careful planning and scheduling of the campaign, the enthusiasm of the sales force, the quality and price of the range (which, no doubt, made a direct appeal to conservative and prudent New Englanders) were vital factors in the success of the sale.

Kitchen Range Burners

Lowell actively engaged this Fall in the sale of Kitchen Range Burners. Past surveys revealed a potential market for kitchen heaters. Our house heating rate:

First 400 cubic feet or less per month	$1.00
Next 600 cubic feet per 100 cubic foot	.12
Next 4,000 cubic feet per 100 cubic foot	.10
Next 15,000 cubic feet per 100 cubic foot	.063

permitted aggressive sales activity in this field. We realized what a tremendous load-building value this service furnishes, but, prior to this year, we lacked an efficient burner to meet our demands.

The development of the Welsbach Burner and the successful experience had with it by a neighboring utility induced us to do some experimenting this year, so it was decided that we sell forty burners during the Fall Sale.

The burner sold for $22.00 cash, or, on the rental plan, for $26.00—$2.00 down and 50c per week.

For determining the approximate cost to operate the burner during the heating season, homes were classified: Class A, with central heating plant; Class B, with central heating plant used only when absolutely necessary; Class C, without central heating plant. Although the desirability of securing installations in homes with central heating plants was pointed out to the salesmen, a comparison of heat equivalents and costs enabled them to sell to all types of homes on the basis of fairly accurate estimates of operation costs.

Newspaper advertising stressed the type, cost, and efficiency of the burner; the low operating cost; the facility of installation; the convenience, flexibility, and superiority of gas heat.

On the sales floor an old coal range was equipped with the burner. A kettle of steaming water, placed on the range, was particularly effective in attracting attention to the display.

A bonus of $1.00 per installation served as a good stimulus to our salesmen, and the novelty of selling this entirely different appliance aroused and held their interest.

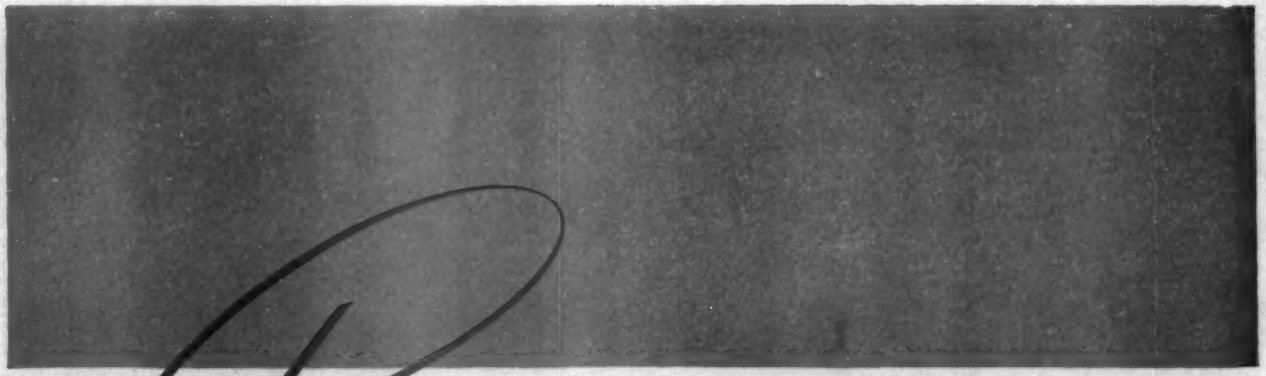
During the sale, 50 burners were sold.

To date, our results in kitchen heating have been most satisfactory, and, upon the basis of the entire winter's experience, a constructive policy of expansion will be devised.

Miscellaneous

During the Fall Sale, automatic

(Continued on page 58)



Presenting

1935 AIR-COOLED ELECTROLUX

JURIES OF WOMEN SAY IT'S "EASILY THE BEST LOOKING OF THEM ALL"

New Beauty!
Greater Efficiency!
Added Conveniences!
A Powerful Advertising Campaign!

A 7-PAGE ANNOUNCEMENT *which means* NEW PROFITS
and INCREASED LOAD *for you in* 1935!

ELECTROLUX
—this time

Gratefully acknowledging the wholehearted cooperation of the gas industry in the enterprise to secure the greatest public acceptance for gas refrigeration, Servel, Inc., has left no stone unturned to make this appliance in 1935 one that every gas company will be proud to recommend and sell. The 1935 Air-Cooled Electrolux has been virtually transformed in appearance—not simply redesigned to what the manufacturer believes will please the American public, but newly styled by American women themselves! Greater efficiency and many new worthwhile conveniences have also been added to make Electrolux even more desirable and attractive to gas users. Finally, to support gas company sales activity to the fullest, there has been provided the biggest, most powerful national advertising campaign in gas refrigeration history. In presenting the 1935 Air-Cooled Electrolux, therefore, we do so with the sincere conviction that it offers opportunities never before equaled for the furtherance of gas refrigeration and the publicizing of gas as the modern fuel.

Louis Ruthenburg

President, SERVEL, Inc.

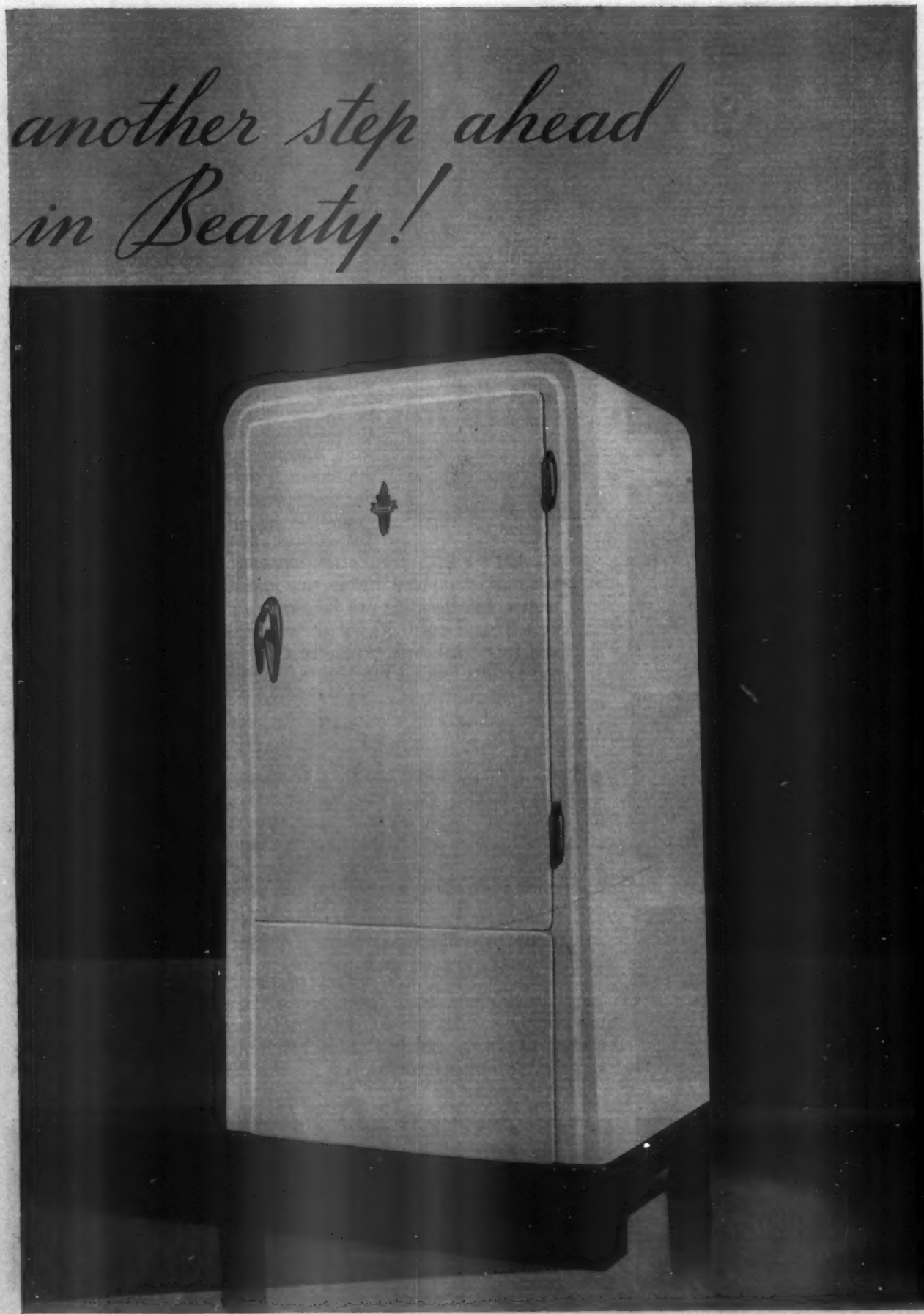
● **Today, when American women are bending every effort to make their kitchens more attractive, the 1935 Electrolux offers them a refrigerator for their kitchens whose design they themselves helped to create.**

In bringing the judgment and advice of American women to aid in styling the 1935 Electrolux, groups of housewives were shown the latest models of several leading makes of refrigerators from which identification marks had been removed. A poll was taken and the vote showed a decided preference for the design of one particular refrigerator.

Meanwhile, a full-sized wood model was completed from designs submitted by a famous New York designer. This model was set up alongside the cabinet which had received the most votes, and new juries of women were brought in for voting. The result of this second poll showed a marked preference for the wood model, and the comments received at this time influenced improvements.

Deciding vote!

For the final voting, five additional small-scale models were built, incorporating the suggestions of Electrolux engineers. These, together with the modified wood model already voted on, were then submitted for a third poll to new groups of typical American housewives. The strong consensus of opinion furnished by this vote gave the definite evidence needed upon which to base the design for the 1935 Electrolux.


another step ahead
in Beauty!

And NEW BEAUTY is ELECTROLUX

Trigger cube release

Rubber grid

Egg and fruit rack

Interior light

The gas industry may well be proud of its refrigeration sales success during the past twelve months. New territories were opened up to this modern gas appliance. During some periods production was pressed to keep up with an ever-increasing demand for Electrolux. Yet to date, the surface of the valuable market for gas refrigeration has only been scratched. With the new eye-appeal and service-appeal now offered by Electrolux, 1935 promises to far surpass even last year's highly gratifying record. There is no question that new profits and increased load await the gas companies that put real sales effort behind Electrolux in 1935.

Vice President, SERVEL, Inc.

● While designers and housewives were busy making Electrolux the most beautiful refrigerator of them all, Electrolux engineers carried forward their work with equal zeal. Electrolux was studied from top to bottom.

New improvements sought!

Improvements were sought to make the operation of the famous unit even more efficient and to provide all those worthwhile modern conveniences women want most. Thanks to these endeavors, the 1935 Electrolux offers additional reasons why we may feel certain that "a tiny gas flame will operate the refrigerators of America."

Greater operating efficiency!

Always unmatched in important operating advantages—in permanent silence, in low cost to run, in no moving parts to wear—Electrolux now provides extra performance fea-

Extension top shelf

Controlled defrosting

Touch or pull latch

only half the story of vital advances in 1935!

tures. Freezing has been speeded up. Unit capacity has been increased. And there have been many other valuable improvements which space does not permit listing here.

Electrolux has also been equipped with many new conveniences. To the thrill of owning a refrigerator that is styled according to the American woman's own specifications, Electrolux engineers have added the enjoyment of practical, useful equipment. As in the past, each new convenience has been given thorough testing and consideration before it has been permitted to go into the Electrolux cabinet.

Conveniences women want most!

The most outstanding of the convenience-features included in the 1935 Electrolux are shown on these two pages—both those that have been retained because of their tremendous success in earlier models, as well as new conveniences provided in Electrolux for the first time this year.

Among the new conveniences certain to win favor with American housewives are the following: a trigger release for the ice cubes, in addition to one for the trays themselves; a glass tray to make the storing of extra cubes easy; a handy egg and fruit container made of the same rust-proof construction as the shelves; an extension-top shelf for keeping bottles close to the chilling unit.

Choice of two gleaming white finishes!

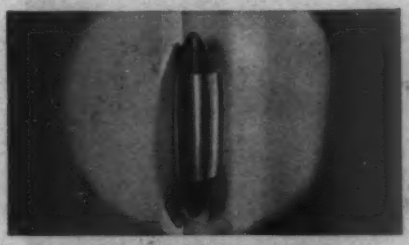
In selecting the finishes for the 1935 Electrolux, the advantages of the various types were carefully weighed. Models will be available both in Porcelain and Newtone. The well-known qualities of porcelain still make it the preference of some. Newtone, however, offers a finish that is highly practical in its happy combination of perfect whiteness, exceptional strength and extreme durability. It will not crack nor flake. Grease will not mar its beauty, nor moisture corrode it. We believe you'll agree that the finishes of the 1935 Air-Cooled Electrolux are the ideal complement to the other superior features that have been provided to give this modern gas refrigerator the eye-appeal and service-appeal which mean greater sales for you.

Vegetable freshener

Temperature regulator

Trigger tray release

Flat top



Beautiful hardware

Glass storage tray for ice cubes

No moving parts

EIGHT POWERFUL
are carrying the announcement
Collier's
THE NATIONAL WEEKLY
Good Housekeeping
Liberty
THE SATURDAY EVENING POST
DEC. 1, 1934
GEORGE RECTOR
ANNE CAMERON
ALICE DUER MILLER
TIME
The Weekly Newsmagazine
BETTER HOMES & GARDENS

NATIONAL MAGAZINES *of the* 1935 ELECTROLUX

into 14,000,000 homes . . .

These well-read magazines are reaching *your* customers . . . telling *them* in dramatic terms the story of the new beauty and advantages of Electrolux . . . strongly supporting *your* local refrigeration sales efforts in 1935!

● The unmatched advantages of Electrolux ownership will be told to even more American families through national magazines in 1935 than last year. The seven magazines used so successfully in 1934 are again being used and, in addition, the important mass circulation of the national weekly, Liberty, has been added.

Read by whole family!

The hard-hitting, convincing messages carried by these magazines will be read by the *whole* family . . . by husbands to whom the exclusive operating features of Electrolux appeal so strongly as well as by wives who will find in the 1935 Electrolux everything they dreamed of in refrigerator beauty and convenience.

The number of families that Electrolux's extensive magazine advertising will reach in 1935 totals over *fourteen million*. The eight magazines which have been chosen to do this job include the three great national weeklies, Saturday Evening Post, Collier's and Liberty; the big favorites in the home service field, Good Housekeeping and Better Homes & Gardens; the influential weekly news magazine, Time; and the two well-read fiction monthlies, Cosmopolitan and American.

The 1935 Electrolux advertising campaign will be timed to open with the early spring selling drive and will continue, with increasing momentum, into the big summer refrigeration sales season. Each week . . . each month, these great national magazines will be making valuable calls in *your* territory . . . making valuable calls on *your* customers.

Plan Now!

By planning your local sales effort to get in *right at the start* of this year's Electrolux activity, you can take *full* advantage of the powerful support offered by 1935 Electrolux advertising . . . achieve the record-breaking success which awaits every company that wholeheartedly goes after Electrolux sales during the next twelve months!

These advertisements will run in* FULL COLOR *in The Saturday Evening Post

NEWS of the GAS INDUSTRY

Veteran Home Expert Observes Anniversary

Anna J. Peterson, cooking expert and veteran Chicago radio home economist, observed her 12th anniversary on December 11, 1934, as adviser to millions of housewives in Chicago and the middle west on her Home Service program, sponsored by The Peoples Gas Light and Coke Company. It is the oldest program of its type on the air, and it has been heard without interruption since she inaugurated the series over the pioneer station KYW in 1922.

Thirty million mimeographed copies of Mrs. Peterson's recipes for menus and dishes have been distributed to housewives since 1922. She addresses her remarks to the microphone as she would to an individual housewife and shakes her finger at it to drive a point home.

Through the twelve years she has been commuting for each broadcast from her home in Elgin, Illinois. There she grows her own vegetables and raises flowers with the same enthusiasm which she puts into her lessons for housewives.

Mrs. Peterson is Irish, with a married daughter and three grandchildren. She is only five feet, four inches tall but commands so much respect that none of her associates would think of calling her anything but Mrs. Peterson when she is within earshot. But among themselves, they refer to her affectionately as "Anna J."

During her twelve years of service 360,000 listeners have written her personal letters; nearly 350,000 have telephoned her for advice on cooking; about 1,000,000 housewives have made personal calls to see her; 900,000 attended her lectures under auspices of the Peoples Gas Company and 300,000 attended outside speeches and demonstrations.

Huge Map Shows Gas Heat Installations

Graphically illustrating the contention of the Peoples Gas Light and Coke Company that "gas heat covers Chicago" is the gigantic map which has been placed in the main floor corridor of the Gas Building in Chicago.

Despite the huge size of the map, there was not room in it to show every installation of the 17,000 in use inside the city. The way in which the pins are spread out over the entire city, except in the manufacturing districts, shows that gas heat is being accepted by those of moderate income as well as by residents of the "Gold Coast."

Viewed by between 15,000 and 20,000 people who pass through the Gas Building's corridors every day, the map has attracted an unusual amount of attention, part of it probably due to the inherent fascination which maps have for almost everyone. People also seem to enjoy finding out whether their neighbors or friends have installed gas heat, by tracing the pins shown on the map.

The map has caused considerable comment from people who thought that gas heat was being sold only to the wealthier Chicago families, and who are surprised to find that "gas heat covers Chicago."

Mrs. Peterson serving the birthday cake which commemorates her twelve years of uninterrupted radio broadcasts on home service problems.

Albert F. Craver Wins Award

During the Convention of the American Gas Association in Atlantic City, the National Bureau of Standards conducted a contest as to accuracy and consistent adjustment of gas ranges.

Mr. Albert F. Craver, chief engineer of The Cleveland Heater Company, was awarded a certificate for excellence for making the most accurate and most consistent settings of both gas rate and primary air among forty contestants in a contest open to all comers.

Ownership Analysis of Consolidated Gas Stock

Nearly eighty per cent of the holders of the common stock of the Consolidated Gas Company of New York own less than one hundred shares each, according to a recent announcement by Geo. B. Cortelyou, President. A total of 94,769 stockholders own the Company's common stock, and 75,635 of this number own from one to ninety-nine shares.

More than fifty per cent of the common stock is held by stockholders whose individual holdings are one thousand shares or less.

Owners of the Company's common stock live in every one of the forty-eight States, Canada, and many foreign countries. Nearly fifty per cent, or 46,396, of the stockholders live in New York State. Massachusetts is second with 15,134 owners. The State with the smallest number of stockholders is South Dakota, with twelve holders owning 379 shares.

On the list of common stockholders are 149 insurance companies owning 450,412 shares; 95 educational institutions with 34,202 shares; 119 charitable institutions with 29,143 shares; 76 religious institutions with 9,775 shares; 3,703 banks and trust companies are fiduciaries with 521,453 shares; 2,224 individuals as trustees with 415,916 shares; 224 individuals as guardians with 5,746 shares; and 32 fraternal organizations with 5,345 shares.

The Consolidated Gas Company's $5 Cumulative Preferred Stock is also widely held. A total of 22,902 shareholders own the 2,099,249 shares. Outside of the classification "individuals," the largest group is that of banks and trust companies as fiduciaries, with 1,819 holders accounting for 122,867 shares. Every State in the Union is represented on the preferred stock list except North and South Dakota.

In discussing the wide ownership of the Company's stock by small investors, Mr. Cortelyou said that the number of stockholders had increased by more than 4400 during 1933.

"Analysis of the stock ownership of the company is interesting," said Mr. Cortelyou, "in its disclosure of the preponderence of small holders. Equally interesting is the variety of institutional ownership, when you visualize the large groups of people whose well-being is thus held in representative capacity. Such a stock list is truly a cross section of our population."

The Gas Industry in 1934

The gas industry in the United States in 1934 showed an improvement for the first time since 1930, registering an increase in customers, sales and revenue over the preceding year, according to Alexander Forward, Managing Director of the American Gas Association.

Manufactured and natural gas companies, supplying towns and cities with a population of 80,000,000, served a total of 15,700,000 customers. Of these, 10,000,000 were served by the manufactured gas industry and the remaining 5,700,000 were served by the natural gas industry. Sales of the manufactured gas industry gained 6.9 per cent over 1933, aggregating 363,000,000,000 cubic feet. Public utility sales of the natural gas industry, excluding carbon black and field use, amounted to 934,000,000,000 cubic feet, an increase of 14.1 per cent over 1933. Revenues of the industry totalled $698,000,000. Manufactured gas companies earned $382,000,000 and natural gas companies $316,000,000, a gain of only 1.1 per cent and 4.6 per cent respectively.

Investment in the gas industry was approximately the same as for 1933. For the manufactured gas industry investment amounted to $2,500,000,000 and for the natural gas industry $2,300,000,000.

Gas range sales in 1934 showed remarkable increase. Approximately 1,000,000 gas ranges were sold in the year, representing a gain of about 280,000, or nearly 40 per cent over 1933. It is interesting to note that nearly 70 per cent of these sales consisted of relatively high priced ranges incorporating modern automatic features, such as oven heat control, etc.

Formation of the British Gas Federation

The governing bodies of the Institution of Gas Engineers (1863), the National Gas Council of Great Britain and Ireland (1916), the British Commercial Gas Association (1911) and the Society of British Gas Industries (1905), have formed, without alteration of their respective constitutions and work, the British Gas Federation, with the object of furthering the interests and welfare of the Gas Industry. The Right Honorable Lord Macmillan has been elected President.

The headquarters of the Federation are located at 28, Grosvenor Gardens, London, S.W. 1, England.

Building Insulation Tables

Four sets of tables, showing the coefficient of transmission for various building insulants, have been prepared by the Industrial and House-heating Committee of the New Jersey Gas Association. The tables have been printed on sheets that can be easily inserted in the association's House-heating manual. The four sheets have been distributed gratis to holders of the manual.

Additional copies of the manual, which have enjoyed international distribution, are available at a special price of $1.50. Address the Secretary, 80 Park Place, Newark, N. J.

Georgia Public Service Commission Orders Reduction in Rates

Reductions in gas rates for 21 out of 22 cities using natural or manufactured gas in Georgia have just been ordered by the Georgia Public Service Commission following investigations under a rule nisi which have been going on for a period of six weeks.

The reductions ordered range from 9% to 20% and will average a little more than 14% for the fourteen largest cities in the state. Valdosta had the lowest reduction ordered—9%—while Columbus, Ga., had the highest—20%. A reduction of 10½% was ordered for Atlanta, 16½% for Savannah, and 17½% for Macon.

A comparison of old and new rates in Columbus, which suffered the most severe reduction of any city in the state, is as follows:

	Old Rate	New Rate
Service charge	$1.00	$0.75
First 2,000 cubic feet	1.45	1.20
Next 3,000 cubic feet	1.10	0.95
Over 5,000 cubic feet	0.75	0.70

A comparison of the old and new rates for the Georgia Natural Gas Corporation, which operates a number of natural gas properties in the state, is as follows:

	Old Rate	New Rate
Service charge	$0.85	$0.75
First 2,000 cubic feet	1.40	1.25
Next 3,000 cubic feet	1.20	1.00
Next 15,000 cubic feet	0.95	0.75
Over 20,000 cubic feet ...	0.75	0.70

Included in this list of properties are the gas systems in Barnesville, Calhoun, Carrollton, Cedartown, Forsyth, Milledgeville, Newnan, Rockmart and Thomaston. All received a reduction of 9% in present rates.

Servel, Inc. Holds Annual Sales Meeting at Evansville, Ind.

An optimistic picture for the marketing of Electrolux refrigerators in 1935 was painted by executives, sales, advertising and promotion managers, at the annual Servel sales conference which was attended by more than a hundred field representatives of the company. The conference lasted throughout the week of December 11-15, at Evansville, Ind.

F. E. Sellman, vice-president in charge of distribution, who presided at all the sessions, told of the company's success during the present year with sales 49 per cent above those of the previous year. Present indications, Mr. Sellman stated, presaged further gains, in support of which he further announced that factory shipments from November 1 to December 10, 1934, showed an increase of 237 per cent over those in the similar period in 1933.

President Louis Ruthenburg, at the opening session, announced a policy for 1935 that will demand larger selling efforts in the off seasons in order to maintain a better spread of employment at the Evansville plant throughout the year. Speaking on "The Background of 1935 Operations," Mr. Ruthenburg said:

"Our 1935 Electrolux production will be characterized by more uniform scheduling throughout the year than has been the case in prior years. This policy will result in more uniform employment and in lower costs of manufacture offsetting to some extent increased cost of labor and material. By following this method we expect to correlate a special obligation and an economic need.

"Because of improved design in the 1935 Electrolux refrigerator, better values and an experienced, well seasoned selling organization, and because of the confidence, enthusiasm and aggressiveness that must be engendered by these factors, there can be no doubt that 1935 will be an Electrolux year.

"Attractive appearance is an important feature of the 1935 models and their acceptance by the women of America is assured by the fact that large groups of typical intelligent women have assisted all our designers in every stage of the development of the 1935 cabinets."

An advertising campaign for 1935 described as the largest in the history of Electrolux refrigerator selling, and the advertising "theme" for next year, was outlined by William Reynolds, advertising manager of the company. Mr. Reynolds, dealt with the subject in considerable detail explaining that the gas company salesmen of the country will be aided by extensive advertisements in many leading nationally-read magazines, trade publications and farm papers.

Electrolux advertising next year, Mr. Reynolds said, would stress four definite points, namely, beauty of design, endorsement by the gas industry, the fact that the company's product is different from other automatic refrigerator types and that it is preferred by men as well as women.

The 1935 Electrolux models were unveiled during the conference by Dr. William R. Hainsworth, director of engineering for Servel, Inc., who told delegates of the development of the latest improvement in the company's refrigerator products from the science standpoint.

Change in Corporate Name

The Bordua Co., Warren, O., announce the change in the company name to Beaver Pipe Tools, Inc. The change in name is designed to identify the name of the company with the name of their product.

Brown Instrument Company Consolidates With Minneapolis-Honeywell—Will Function Independently

The recent consolidation, whereby the Brown Instrument Company of Philadelphia, became a subsidiary of Minneapolis-Honeywell Regulator Company of Minneapolis, unites two of the largest and oldest firms in the temperature control field.

Both companies are pioneers, the Brown Instrument Company having been established in 1860, while the Minneapolis-Honeywell Regulator Company was organized in 1885. Today, Minneapolis-Honeywell maintains branch and distributing offices in fifty-eight cities and subsidiary companies in Canada and Europe. The Brown Instrument Company maintains twenty-two branches throughout the United States.

The consolidation, which marks another step in the growth of the Minneapolis-Honeywell Regulator Company, comes on the eve of its 50th anniversary and completely rounds out and complements its line of heating, ventilating, cooling, humidifying and air conditioning control equipment for domestic and large building applications as well as its line of automatic industrial process controls.

The Brown Instrument Company's business has been exclusively in the industrial field and consists of a complete line of instruments for indicating, recording and controlling of temperatures, pressures, flows, liquid levels, CO_2, speeds, etc., serving such varied industries as oil, power, steel, chemical, glass and automotive industries. The Brown Instrument Company will be operated as a separate company and it is expected that all of its branches and personnel will be maintained. Both companies will maintain their own identity in the sales field.

Indiana Service Corp. Centralizing Offices at Fort Wayne

The accounting and general offices of the Indiana Service Corporation, are to be centralized in Fort Wayne, Ind., soon, it has been announced by John N. Shannahan of Indianapolis, chairman of the board of directors. He also announced that B. P. Shearon, secretary-treasurer of the Indiana Service Corporation and of the Northern Indiana Public Service Company, has submitted his resignation as treasurer and has been named secretary and controller of the Indiana Service Corporation.

Harry W. Vordermark of Fort Wayne, Ind., has been elected treasurer and James S. Clark, also of Fort Wayne, has been named assistant treasurer of the Indiana Service Corporation.

Pendleton, Ind., Gets Additional Gas Supply

The Pendleton Gas Company, Pendleton, Ind., has contracted for gas from the Indiana Gas Transmission Company, which has a pipe line north of Pendleton. This is expected to give the city, along with its present gas supply, service for all purposes.

Wm. H. Matlack Placed in Charge of Advertising and Sales Promotion for Illinois Power & Light Co.

Wm. H. Matlack has been transferred from the East St. Louis, Ill., office of the Illinois Power & Light Co. to their Champaign, Ill., office, where he will direct all the advertising and sales promotion work of the 331 cities and towns in the system. Mr. Matlack is editor of "East St. Louis Today," "The Lions Tail," the Lions Club weekly news-letter and is now editor of "The Triangle," a publication of the Ill. P. & L. Co. employees. Mr. Matlack has been a regular contributor to the JOURNAL for a number of years. His articles on appliance sales have been widely commented on for their originality.

Northern Indiana Public Service Co. Announce Promotions

Three major promotions and a reassignment affecting the executive personnel of the Northern Indiana Public Service Company, Hammond, Ind., have been announced by Dean H. Mitchell, vice-president and general manager.

C. V. Sorenson, for many years sales director for the Public Service Company of Indiana and its affiliates, has been named general sales manager for the Northern Indiana with headquarters at Hammond, Ind.

Guy M. Johnson, in charge of the company's South Bend division for 16 years, has been appointed general superintendent in charge of the production, transmission and distribution of gas for the entire system.

David L. Bement of Hammond, Ind., has been promoted to general superintendent over the production, transmission and distribution of electric energy for the system.

Acid-Proof Rubber Covering Applied to Large Exhaust Fan Unit

The practicability of utilizing acid-proof rubber covering to eliminate destructive corrosion is exemplified in the accompanying illustration showing large exhaust fan units recently rubber covered by The Manhattan Rubber Mfg. Division, Passaic, N. J.

This covering is a specially-developed acid-proof rubber compound applied by a perfected process to the metal surfaces of the fan unit.

The process of uniting rubber to metal holds the rubber covering in place so tenaciously that after vulcanization, the cover cannot be removed without tearing and destroying it.

Worthington Establishes Regional Headquarters on the West Coast

Worthington Pump and Machinery Corporation has recently established a Pacific Coast regional headquarters at Los Angeles, which will center jurisdiction and development of the Corporation's business in the western terrain now included in the coverage of the Worthington district offices in Seattle, San Francisco, Los Angeles and El Paso.

This headquarters, under the direction of an executive officer of the Corporation, will supplement the efforts of the present district offices and unite with them for the dispatch of business and service of Worthington business in the West. Mr. C. E. Wilson, Vice-President, is in charge of this Pacific Coast Division and accordingly has moved his office from New York to new headquarters at 510 West 6th Street, Los Angeles.

Mr. Wilson has for many years been well known in the pump and power equipment field, having in his earlier experience filled many important offices in the various departments of the former Geo. F. Blake Manufacturing Company and its successors, which subsequently became a part of Worthington.

Monobloc Centrifugal Pump

Worthington Pump and Machinery Corp., Harrison, N. J., recently issued a four page folder describing the new Worthington Monobloc Centrifugal Pump. A unique feature is the unit construction of the impeller consisting of two enclosed type impellers cast back to back, which makes the overhung weight no greater than on a single-stage pump.

Oklahoma Natural Gas Company Organizes Home Service Department

During the past three years the Oklahoma Natural Gas Company has operated a Home Service Department at its Oklahoma City and Tulsa Districts, and due to its successful operation, it was decided to organize a complete department in all its districts. Miss Mildred R. Clark, who had been the director at Oklahoma City since September, 1931, has recently been promoted to Supervisor of Home Service and a very thorough program has been laid out. Miss Clark is a graduate of the University of Oklahoma and has organized the following personnel for the New Home Service Department.

At Tulsa, Miss Emma Mae Deichman, a graduate of Oklahoma A and M College at Stillwater, is the director of Home Service for the entire district, with Miss Rosemary Locke, graduate of Iowa State College at Ames, Iowa, as assistant director.

Mildred C. Clark

Miss Doris McKnight is director at the Enid district office, having recently graduated from Iowa State College.

A very attractive Home Service Room has just been installed at the Muskogee District office, with Miss Nina Provost, a graduate of the University of Oklahoma in charge.

At Oklahoma City District office, Miss Harryette Hunter was appointed director, with Miss Rachael Bonebrake as assistant. Miss Hunter graduated from Oklahoma College for Women and Miss Bonebrake from Oklahoma University.

All are graduates of Home Economics of their respective colleges.

Home Service Work in other districts will be handled as follows: Out of Oklahoma City Headquarters: Ardmore, Shawnee and Chandler. Out of Tulsa: Okmulgee and Chandler. Out of Muskogee: Okmulgee. Previous to the installation of these directors in district positions, a six weeks utility training was conducted and will be continued from time to time in departmental training conferences.

The Home Service Department has been organized as a separate department but is cooperative with the general and local sales departments. Miss Clark the supervisor, states that the purpose will be to build good will; educational with consumers, dealers and employees and to increase gas revenues by demonstration of modern appliances. A very extensive program has been laid out for 1935 with cooking schools and demonstrations in all communities served; gas appliance shows; weekly food columns in newspapers; home call program; special group lectures with various clubs and organizations.

During the past year this department has made 18,000 contacts through its clubrooms located at Oklahoma City, Tulsa, Enid and Muskogee, and it is believed that the expansion of this Home Service Work will prove of great value to the Oklahoma Natural Gas Company.

Henry M. Brundage Retires

Henry M. Brundage, who retired as vice-president of the Consolidated Gas Company of New York on Tuesday, December 11, was the guest of honor on Thursday, December 6, at a dinner at the University Club given by sixty of his associates. Geo. B. Cortelyou, President of the company, presided.

The testimonial dinner had double significance, since the day Mr. Brundage selected to start his retirement also was the day on which he completed forty years of continuous service with the Consolidated Gas Company.

Among the speakers at the dinner were Mr. Brundage's first "boss" in the gas company, W. Greeley Hoyt, now President of the Standard Gas Light Company. Frank W. Smith, President of the New York Edison Company, and other officials of the companies in the Consolidated System also spoke. Mr. Brundage was presented with a pair of binoculars.

Mr. Brundage has a wide acquaintanceship in utility circles, having been identified with national and state utility organizations for many years. He served as treasurer of the American Gas Association from 1920 to 1926, and as President of the Empire State Gas and Electric Association in 1926 and 1927. One of his major contributions was his work on a uniform classification of accounts for the utility industry.

Mr. Brundage has been called the "father" of the American Gas Association's Accounting Section, and has been the head of many of its important committees. He also was the organizer and first president of the Society of Gas and Electric Accountants, a local organization.

Mr. Brundage was born in White Plains, N. Y., and moved with his parents, while very young, to Port Chester, N. Y., where he has lived ever since.

Mr. Brundage considers the gas business his real life work. It was on December 11, 1894 that he first went to work in the general office of The Standard Gas Light Company.

In 1911 Mr. Brundage was transferred to The United Electric Light and Power Company and was transferred two years later to the Consolidated Gas Company as chief clerk of the Accounting Department. He subsequently served as controller, assistant secretary, secretary, and in October, 1924, was elected a vice-president. All matters pertaining to accounting, auditing, insurance, taxation, and related activities have come under Mr. Brundage's jurisdiction.

Henry M. Brundage

New Bulletin Issued

A new twelve-page bulletin describing the Emco Type B Ejector Service Regulator has recently been issued by the Pittsburgh Equitable Meter Company, Pittsburgh, Pa.

This development by Emco engineers offers three definite improvements without materially changing the design and construction of Emco service regulators which have proven successful over a long period of years. Effective automatic loading, low shut-off and increased capacity have all been made possible through a real and detailed study of the flow stream of gas as it emerges from the valve; correct proportioning of the spring and the use of the exclusive Emcomold Valve.

Copies of this bulletin may be secured by writing the Pittsburgh Equitable Meter Company, 400 North Lexington Ave., Pittsburgh, Pa.

Republic Steel Issues Rotogravure Tabloid

The Republic Steel Corp., Massillon, O., recently released a rotogravure tabloid containing 12 pages of illustrations of exhibits at the 1934 Century of Progress Exhibition in Chicago. It illustrates the various uses of their product in a large number of items for business and the home.

A copy of the tabloid can be had on request to the company and it is called Bulletin 135.

The Republic Steel Corporation has also just issued the fifth edition of "Sheet Iron a Primer," containing 64 pages profusely illustrated and written in simple non-technical language. It tells the step-by-step story of modern manufacture, tracing production from ore mine to the final inspection of the completed sheet. It is referred to as Bulletin 127 and copies may be had by addressing the company at Massillon, O.

EQUIPMENT NEWS

New Refractory Booklet

Harbison-Walker Refractories Company, 1800 Farmers Bank Building, Pittsburgh, Pennsylvania, has issued a folder entitled "Insulate With Safety at Any Temperature." It emphasizes the importance of the selection of the proper refractory as well as the proper insulating material for any insulated furnace construction and describes both insulating brick and light weight brick and their applications. The information given applies to three types of brick as follows:

HW-777, a diatomaceous earth brick possessing unusual mechanical strength for brick of that type and a safe working temperature of 2000° F.

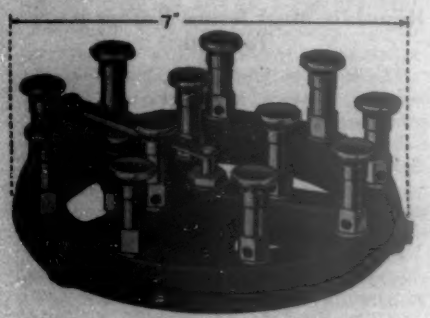
HW-111 light weight brick, made from flint fire clay, weigh approximately 2.8 lb. each, will withstand temperatures up to 2500° F. without shrinkage or other sign of deterioration and are particularly noted for their high mechanical strength.

HW-444 light weight silica brick weigh approximately 2.8 lb. each and may be used with complete safety at temperatures up to 2900° F. without danger of shrinkage or loss in insulating value.

Copy of booklet will be mailed on request.

Barber Announces New Burners For Special Purposes

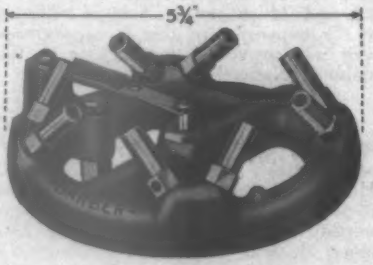
The Barber Gas Burner Company of Cleveland, Ohio, manufacturers of conversion burners for house heating purposes, have now developed and are marketing an additional line of burner units for special industrial and commercial uses.



No. M.P.—12 Barber Burner

These new burners are expecially designed for use in such appliances as the following: Banana Room Heaters, Circulating Heaters, Clothes Dryers, Coffee Urns, Coffee Roasters, Cone Machines, Floor Furnaces, Pop Corn Machines, Garage Heaters, Hair Dryers, Laundry Stoves, Space Heaters, Steam Tables, Sterilizers, Warming Ovens, and Water Heaters.

A feature of importance in all these Barber Burner units is the fact that they have in every instance, as an integral part of the burner, a fully Automatic Safety Pilot Control. Considering the fact that such appliances are usually installed and operated in public



No. S.P.—15 Barber Burner

places such as hotels, clubs, restaurants, institutions, schools, beauty parlors, etc., the safety feature provided by the automatic control is a vital point in protecting both employees and patrons against accidents and fire hazards.

In the case of Multiple Hair Dryers, the gas-electric feature makes possible considerable operating economy over the all-electric dryers. This company has incorporated in their products the recommendations of the American Gas Association Testing Laboratory as to safety, economy, and efficiency of operation.

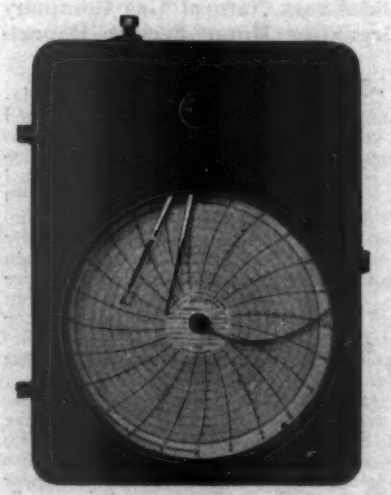
American Meter Co. Announce New Type W Case

An important advance in appearance, utility and convenience of orifice measurement and flow control instruments is announced by American Meter Company, New York, N. Y., in the development of their new Type W case shown in illustration.

The improved case is now standard for this company's entire line of recording and integrating flow and orifice meters, rate-volume controllers, liquid level indicators and controllers.

The case body and door are cast of an aluminum alloy with special attention to the construction of door hinges and hinge pins, which are produced from special alloys to minimize the possibility of corrosion. A sponge rubber gasket secured in a recess of the door makes the case moisture and dust proof.

Both time and labor are saved in the necessary inspection of the instrument by making the chart dial size such that the pressure spring, stuffing box and other working parts are visible when the door is open. The new case is made highly satisfactory for flush mounting.

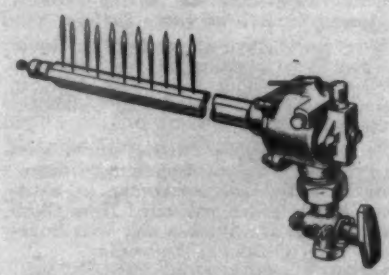


For that type of installation a flange is cast integral with the case, the door being hinged to the flange.

For the flow control instruments, the Type W case has the air supply gage, and the gage indicating the pressure on the diaphragm head of the control valve, mounted on brackets secured to the inside of the case. The door is provided with two additional round windows, making these gage indications visible at all times. The construction here also facilitates flush mounting since all air connections are behind the panel board and are made into flanges secured to the sides or back of the case.

Welsbach E-Z Lite Burner Develops New Gas Sales Outlet

An agreement has been entered into between the Welsbach Company, Gloucester, N. J., and the Roberts and Mander Stove Company, Phila., Pa., whereby the latter has been granted permission to use the Welsbach E-Z Lite Burner in their combination ranges. The purpose is to further the use of gas for kitchen heating.



The E-Z Lite Burner is very economical, burns gas with a quiet luminous flame, has no air shutter to adjust and no gauzes to stop up. It has incorporated in it a 100% safety gas shut-off.

Several thousands of E-Z Lite Burners have been installed during the past Fall in straight coal or combination coal and gas ranges as a conversion unit.

SUPERIOR

Gas Meters
Provers
Service Cleaners
Diaphragms
Repairs

SUPERIOR METER CO.
167-41st Street
Brooklyn, N. Y.

Modern Carbonizing Systems

Installation of "West-Vertical" Intermittent Chambers at Tilburg, Holland, March, 1934

GLOVER-WEST
CONTINUOUS VERTICAL RETORTS

Making gas in 355 installations—whose yearly production is from 6000 to 8000 millions. The logical plant for maximum gas yield.

WEST-VERTICAL
SEMI-INTERMITTENT VERTICALS

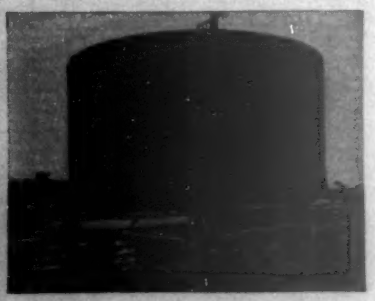
As an alternative when a demand for coke of a special character must be met.

Combining the proved advantages of continuous carbonization with the best features of intermittent carbonization.

WEST GAS IMPROVEMENT COMPANY
424 Madison Avenue — BUILDERS OF COAL GAS PLANTS — New York, N. Y.

Move 10,000 Bbl. Tank

The unusual feat of raising a one hundred ton, ten thousand barrel tank vertically fourteen feet from the ground level to an elevated railroad right of way and moving the unit intact five hundred yards has just been accomplished in Chicago. The three year old



cone-roof, bolted and welded tank (52' 6" x 27' 3") was sold by the Hughes Oil Company to the Seneca Petroleum Company. It contains eight compartments, one circular and seven radials, each equipped with steam coils which were left intact. Usual procedure is to cut a large tank apart to move it, but in this instance, because of the solid construction, this was not deemed necessary. The tank was built by the Graver Tank & Mfg. Corp.

Homestead Heater Elects New Officers

At a recent meeting of the directors of Homestead Heater Co., Newark, N. J., the following officers were elected: President, Julius A. Rippel, Treasurer, E. Allen Smith; Secretary, Richard F. Cleary.

Richard P. Cleary, who has been sales manager of the company practically since its inception, was appointed General Manager of the company.

These changes were made necessary due to the resignation of Mr. Walter Kennedy as President of the company. Mr. Kennedy still retains his interest in the company and continues as a director.

INDUSTRIAL
GAS BOILERS

ASME CODE
TUBULAR & FLUELESS

Sizes from one half to thirty horsepower. 100 lb. boilers in stock. Higher pressures to order.

Automatic Gas Controls
Low Water Gas Cut-offs
Boiler Feed Systems

P. M. LATTNER MFG. COMPANY
CEDAR RAPIDS, IOWA

Pittsburgh Equitable Opens Memphis Office

The Pittsburgh Equitable Meter Company announce the opening of a new District Office at 67 McCall Street, Memphis, Tennessee, effective January 1, 1935.

Mr. Z. A. Stanfield, who has represented this company for many years in a sales capacity, has been appointed District Manager of this new territory, and will have associated with him Mr. J. H. Ferguson and other representa-

Z. A. Stanfield

tives yet to be announced. The Memphis Office will serve the territory comprising the states of Alabama, Mississippi, Kentucky, Tennessee and portions of Louisiana, Georgia and Florida. District headquarters for both the Pittsburgh Equitable Meter Company and its subsidiary, the Merco Nordstrom Valve Company, will be maintained in Memphis.

New Bulletins

Chaplin-Fulton Mfg. Co., Pittsburgh, Pa., have issued Bulletin No. 4146 describing and illustrating their Fulton high pressure toggled reducing regulators with hard seats and soft seats.

Bulletin No. 2018 issued by The Hays Corp., Michigan City, Ind., describing their new line of Hays "Draftrol" electric contact gages for indicating and controlling draft, pressure and differential draft or pressure. Copy of Bulletin will be mailed on request.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., have a booklet titled "Heat Acceleration," which contains a discussion of the facts as regards the latest development in room temperature control. It contains a number of diagrams and illustrations, as well as several pages of questions and answers. Copy can be had on request.

The "Free Gas" Plan of Florida Public Service Co.

(Continued from page 11)

responding month last year. The amount you used in the same month last year billed at the Immediate Rate becomes your "base bill." Should you use the same amount in the corresponding month this year you will have available to you the amount of free gas shown in the accompanying table

Gas Used (100 Cubic Feet)	Amount of Bill at Immediate Rate	Free Gas (100 cubic feet) at "Objective" Rate
2	$1.00	3
5	1.00	.
10	2.00	1
15	3.00	3
20	4.00	5
25	5.00	10
30	6.00	15
35	7.00	20
40	8.00	25
45	9.00	30
50	10.00	35
60	11.75	42
70	13.50	52
80	15.25	61
90	17.00	71
100	18.75	80
120	21.75	95
140	24.75	112
160	27.75	130
180	30.75	148
200	33.75	165
250	40.00	193
300	46.25	221
500	71.25	334

On the chart is shown the assumed case of a customer who last year used 3,000 cubic feet of gas in November, at a total cost of $6.00. His bill for different amounts of use this November is here shown (1) under the old Schedule A and (2) under the new optional Schedule U. The operation of the "Objective" rate is when the amount of the bill reaches $6.00.

It is still too early to tell how the "Free Gas" plan will succeed. To the public it sounds revolutionary. From the company standpoint however, it is part of a definite and well coordinated campaign to increase the level of sales per customer, and to adjust rates downward as rapidly as conditions permit, so that eventually the company may find itself in a stronger competitive position.

Entirely New

LAVINO GRANULAR OXIDE

LAVINO GRANULAR OXIDE is a standard Lavino Activated Oxide in porous, granular form (made under a Patented Process). It requires no shavings or other carrying medium, but, on the contrary, each granule is entirely available for H_2S removal.

LAVINO GRANULAR OXIDE ACTUALLY SAVES MONEY because:—It gives far greater purification for the dollar expended . . .Requires no mixing . . . Gives about 4 times the Box Capacity . . . Is easier to handle and fill boxes. . . Is used in your present boxes . . . Allows fouled material to be sold for Sulphuric Acid manufacture.

Write for literature—or, better still, ask to have one of our Purification Experts call—without obligation.

E.J.LAVINOandCOMPANY

Bullitt Bldg.

Chicago Philadelphia, Pa. Pittsburgh

Purification

All sizes up to 3,400 cu. ft. capacity

Meters
Diaphragms
Repairs
Provers
Pumps
Calorimeters
Wet Meters
Gauges
Apparatus

METER REPAIR PARTS

FOR

ALL MAKES - ALL SIZES OF METERS

LARGEST GAS COMPANIES NOW USING OUR PARTS

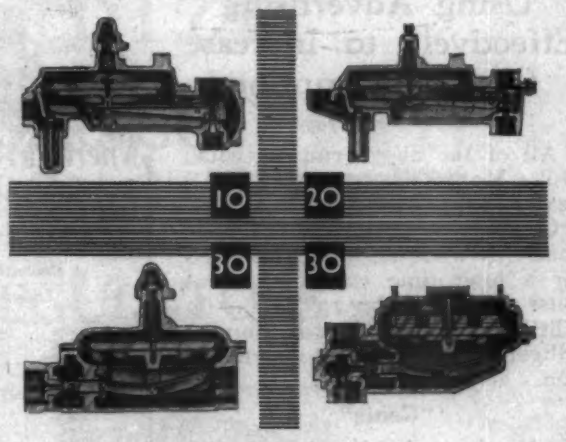
SEND FOR OUR CIRCULAR ON METER REPAIR PARTS

SAMPLES AND PRICES GLADLY SENT

—•—

LAMBERT METER CO.

BUSH TERM. BLDG. 4, BROOKLYN, N. Y.



RESULTS... are what determine successful Gas Control Performance

● Reynolds has more than forty years experience in the Gas Control Field, working out, designing, building, testing gas regulators, and the result: Hundreds of thousands of regulators in use throughout the world, meeting all requirements, giving successful performance.

The Service Regulators featured are built to meet the specific requirements in service regulation. They are guaranteed to give the high quality of performance you demand, over years of operation, with a minimum upkeep. Below are a few characteristics about the different models, 10, 20, and 30. (Model 30 is shown in Spring and Dead Weight Types).

MODEL 10—*Dead Weight or Spring Type,* with or without Mercury Seal, or Dead Weight Safety Seal. All working parts are so accessible as to be interchangeable without removal from pipe line.

MODEL 20—*Dead Weight or Spring Type,* with or without Mercury Seal, or Dead Weight Safety Seal. All working parts are so accurate as to permit complete interchangeability in shop.

MODEL 30—*For horizontal or vertical connections,* with or without removable valve pocket. Available with either Spring or Dead Weight adjustment. With or without Mercury or Dead Weight Safety Seal.

REYNOLDS BRANCH OFFICES:
421 Dwight Bldg., Kansas City, Mo.
2nd Unit, Santa Fe Bldg., Dallas, Tex.

REPRESENTATIVES:
Eastern Appliance Co., Boston, Mass.
F. E. Newberry, Avon, N. J.
G. H. Unekefer, 428 Boyd St., Los Angeles

Have you written for your copy of the Reynolds New Low Pressure and Appliance Regulator Catalog (Catalog L, Section 3)?

REYNOLDS GAS REGULATOR CO.

Anderson, Indiana, U.S.A.

GAS CONTROL SINCE 1892

Using Advertising Effectively to Increase Gas Consumption

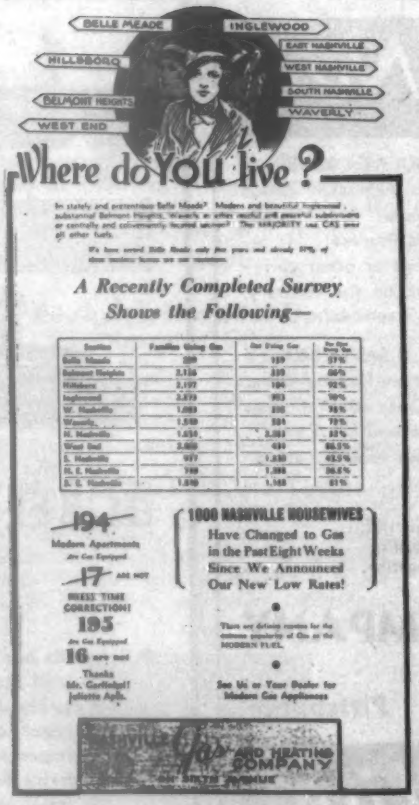
(Continued from page 37)

All of the above end up with: "Like Mother Nature's own, GAS heat is pure, clean, and healthful.

Generally speaking we have done only what has been performed for a long time except that we must move from day to day and do a little more than if we had no intelligent and immediate competition.

"Genie"

We have developed a character to give gas an animated life instead of an unknown and unseen substance. We call him "Genie, the GAS servant." Sometimes he comes out of a hot water pipe, sometimes out of a range, and then from an Electrolux or space heater. He is an impressive creature—not pretty but commanding and we have had a very favorable reaction. The idea is from "GENIE" in "Aladdin and His Wonderful Lamp."



Style Show and Formal Opening

Again following a good example as started by some one else, we conducted a style show when our remodeling was completed. We, perhaps, went a step further in that we had choice equipment from 25 manufacturers on our display floor. We selected good numbers from the better manufacturers and gave a fine range away on the last day. One of the requirements on the deposited ticket was that the entrant must state which range preferred. This gave us an insight into what range or ranges would be expected to sell and what points had the most local appeal. Our display was an AGA display in miniature. No one had ever had the opportunity to really see the many beautiful ranges made by various manufacturers, plus Electrolux, Fagan-Andrews control, automatic heaters and the like.

We installed five principles of heating to enable us to show in practical use, various gas heating installations. The initial cost, efficiency etc., is about the same as if one centralized system were used.

Sears-Roebuck, Montgomery-Ward and local dealers handling various ranges were given space and where customers expressed a desire for their range, the names were given to them. This type of cooperation caused these dealers to run congratulatory ads and send flowers, all adding to the show. Imagine an independent dealer inviting his customers to our show and liking it. He did because he knew he would be given every consideration and this was truly a Gas style show.

10,000 people saw our show during the five days. This we feel is very good, as our total meters are only 15,000.

The Utilities

Before closing we would like to say that while we have been competitive to the electric, we have not been destructive. We ask our men to never capitalize on the unpopularity of the electric company and we hope they take the same attitude. We do not openly fight them for the simple reason that after all we are both public utilities, and in all fights every one has a favorite. For the sake of argument, lets say 50% are for us and 50% for the electric. This means 100% are against some public utility and as long as this condition exists, further destructive reaction will be exercised directly against the electric companies and indirectly against the gas.

The Ending of the Chapter

To me, this entire affair has been seven months of pleasure, and my immediate superior seems hale and hearty after going from the start up to now. So, this might be termed as a chapter in a continued story—we do not know the ending, but the story so far is too darned interesting not to expect a good ——.

Fall—A Productive Sales Period

(Continued from page 42)

water heaters, refrigerators, and coke received their share of sales activity. Newspaper advertising, customer inducements, and salesmen's bonuses helped materially in the sale of 33 automatic water heaters, 41 refrigerators, and 481 coke orders.

At a nearby country club, the executives and sales personnel gathered to award prizes to the salesmen and to celebrate the termination of a most successful Fall Sales Program.

Try Billboard Proportions In Your Window Displays

(Continued from page 34)

ries just as much strength.

One eastern gas company that tried out this billboard type of window advertising received very gratifying results from the activity. The set-up of this company's main windows was such that a set of these billboard size displays could be placed in three windows facing a main artery, carrying heavy traffic. The change of treatment was noticed by passersby who compared it with past designs. As for comparative costs, these billboard sets cost much less than the regular poster panels. There was much less construction, due to the fact that the main area was flat. The art work and lettering item was, of course, about the same.

As a decided change from the poster type of window display generally used by gas companies, the writer earnestly recommends a trial for this billboard type of set-up. Any company using effective display material, created by an efficient display department, could swing over to this long type of design without disrupting the organization routine of the regular program. Try them, you'll find they arrest a lot of attention to your sales and promotional window display messages.

STANDARDIZE

on

SPRAGUE
CAST IRON GAS METERS

and

REGULATORS

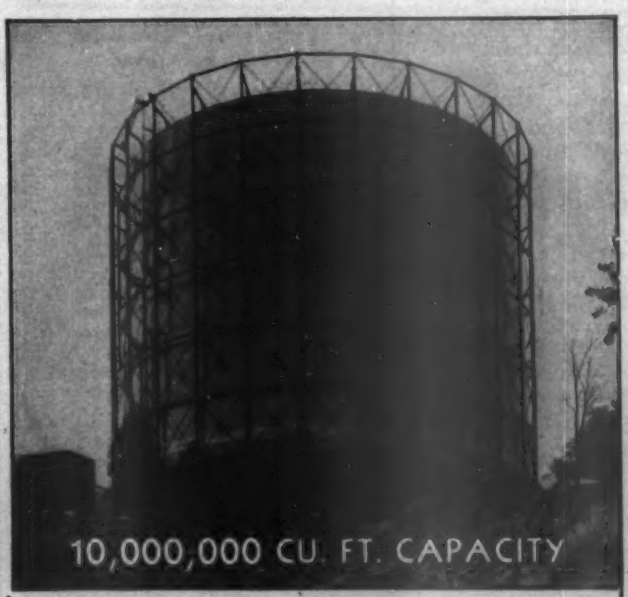
for

low, medium, and high pressures

Accurate in Measurement.
Economical in Service.

THE SPRAGUE METER CO.

BRIDGEPORT, CONN.



10,000,000 CU. FT. CAPACITY

HIGH PRESSURE **GAS HOLDERS** LOW PRESSURE

PURIFIERS · TANKS · CONDENSERS
STEEL PLATE CONSTRUCTION

INTEGRITY GOOD WORKMANSHIP FAIR DEALING

CRUSE-KEMPER CO.
AMBLER, PA.

G-115 Lock Wing "Special"

GAS STOPS
OF QUALITY

GROUND KEY GAS STOPS of Standard, Extra, Special or Heavy Service Types — with Flat Heads, Square Heads, Lock Wings, Lever Handles, etc.—all Brass Stops or Iron Body Stops with Brass Plugs—they're all made by Kitson (and have been for years).

You take no chances when you purchase Kitson Products, for they're guaranteed as to MATERIAL AND WORKMANSHIP.

BE SURE IT'S MARKED "K-CO"

G-101 Flat Head "Special"

KITSON CO.
WESTMORELAND & STOKLEY STS.
PHILADELPHIA PA.

"Since 1897"

Prevention of Bolt and Nut Corrosion in Mechanical Pipe Joints

(Continued from page 25)

bolts from serious corrosion, but the nuts and thread ends of the bolts must also be protected.

2. Shielding the nuts with a circular metallic shield or cup* which forms an integral part of the follower ring should greatly reduce the corrosion of the nuts and threaded ends of the bolts. Filling this shield or inverted cup with a suitable waterproof plastic material should substantially prevent corrosion of the nuts and thread ends of the bolts.

Test Six, Part B consisted of testing the shielding of some Dresser, Doublex, Simplex and Flexklamp joints with a cylindrical metallic shield around each joint, and of such length as to extend beyond the heads of the bolts and nuts in each case. The shields were connected to the pipe or joint by metallic connections.

In all instances this method of protecting the bolts and of reducing losses of the joint assembly were successful under the test conditions, and are probably applicable in a real hot spot. We are not at this time, however, ready to draw conclusions as to the general use or adoption of such shields for joint protection.

Test Seven was made to determine the efficiency and adaptability of some of our developments to other types of joints than those tested, and to test out some variants of the methods of protecting the bolts.

To this end metal shields were made for the nuts consisting of cup washers of such size as to completely shield the nuts. Also bolt head shields were made to protect three sides of the bolt heads, the bell of the pipe forming the fourth side. To protect the shank of the bolts between the flanges of Doublex Simplex and similar joints rubber sleeves were used which were compressed between the flanges as they were drawn up.

The conclusions from Test Seven are:

1. Metal cup shields cast separately* and of the same materials as the follower rings and used to shield the heads of nuts of the bolts will greatly reduce the corrosion of these parts. Filling the cups with a suitable waterproof compound will practically eliminate corrosion of these parts.

2. Suitable waterproof and compressible sleeves* or grommets installed around the shanks of the bolts between flanges will practically eliminate the losses from the shanks.

3. Suitable waterproof flexible caps*, such as rubber, for nuts and heads of bolts either forced on over the bolt heads and nuts or cemented on with a suitable compound will eliminate losses from the heads, nuts and thread ends of bolts.

General Conclusions from All Tests Reference to Bolt and Nut Protection of Mechanical Joints.

1. Insulating the bolts should reduce electrolytic corrosion of the bolts and nuts.

2. *Capping the nuts and heads of the bolts with an insulating material filled with a waterproof plastic should protect the nuts and heads from corrosion.

3. Shielding the heads and shanks of the bolts with metallic shields as is the case with the Flexklamp and R. D. Wood joints should satisfactorily protect these parts of the bolts from serious corrosion.

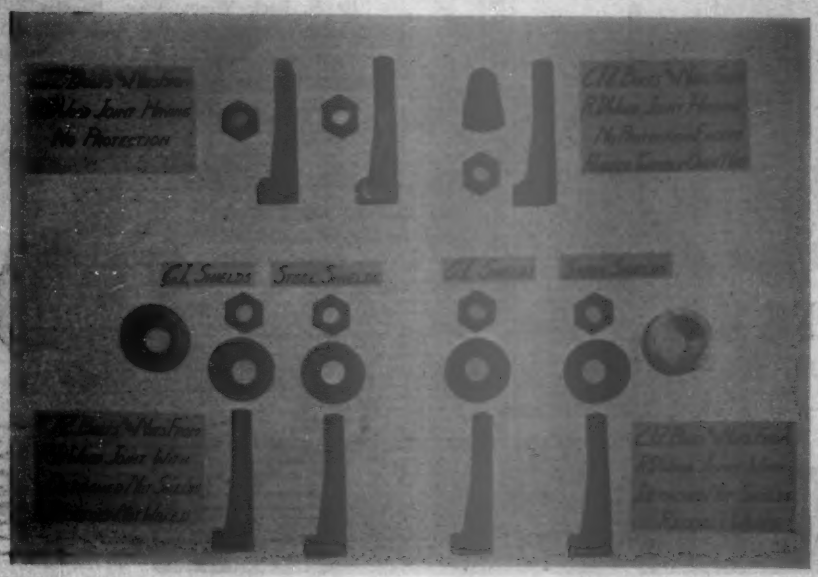
4. The exposed shanks of bolts between flanges should be satisfactorily protected against serious corrosion by the use of suitable waterproof compressible sleeves* or grommets.

5. *Shielding the nuts of bolts with metallic shields which form an integral part of the follower ring should greatly reduce the corrosion of the nuts and threaded ends of the bolts. Filling these recesses or inverted caps with a suitable waterproof plastic material should practically prevent corrosion of the nuts and thread ends of the bolts.

6. Shielding the heads and the nuts of the bolts with separately formed metal cap washers* should greatly reduce the corrosion of the heads, nuts and threaded ends of the bolts. Filling these recesses or inverted caps with a suitable waterproof plastic material should practically prevent corrosion of these parts.

7. Suitable flexible waterproof caps* forced or cemented on over the heads and nuts of the bolts should practically eliminate corrosion of these parts.

* Patents pending.



Middle top bolt is equal to the originals.

Convention Calendar

January, 1935

17 Midwest Industrial Gas Sales Council. Palmer House, Chicago, Ill. Porter W. Hay, sec., 72 West Adams St., Chicago, Ill.

February, 1935

14-15 New England Gas Association, annual convention, Hotel Statler, Boston.

April, 1935

15-17 Mid-West Gas Association, annual convention, Hotel Fontenelle, Omaha, Neb. R. B. Searing, sec., 302 Utilities Building, Sioux City, Ia.

May, 1935

6-9 Natural Gas Department, American Gas Association, annual convention, Hotel Peabody, Memphis, Tenn.

7-9 Pennsylvania Gas Association, annual convention, Skytop Club, Skytop, Pa., F. W. Lesley, secretary, York, Pa.

June, 1935

10-11 Canadian Gas Association, annual convention, Quebec, George W. Allen, secretary, 21 Astley Ave., Toronto, Canada.

October, 1935

14-18 American Gas Association, 17th annual convention, Atlantic City, N. J., Alexander Forward, managing director.

"PEP UP" YOUR WATER GAS MACHINE With this New 3-Way Backrun Valve

SEMET-SOLVAY has built a newer and better valve for Backrun operation to meet the more exacting demands that came with heavy oil carburetion. Note its numerous desirable features: Quick opening door full height of box. Allows easy access for inspection, cleaning and replacement of any working part. Uniform pressure against lute on all sides. ● Dished welded steel discs, strong and not liable to warp. Seating of discs improved; disc seats removable; cushioned seating prevents slamming. ● Two large bearings always in alignment; one above box, the other partially outside; both bearings cooled by radiation. ● Enlarged shaft strengthened against bending. Stuffing box and bearing all within one strong, rigid casting. Tightly fitted bearing avoids stuffing box leakage. ● Arm always rigidly held to shaft by properly fitted keys. ● Adequate spray system reduces carbon and tar accumulations when running on heavy oil. ● Made for any size and type of water gas machine. Shipped assembled with any desired flanges, ready to mount at once. Order this valve now for your water gas equipment and profit by the improvement it will give to machine performance generally.

This valve, and water gas sets equipped therewith, are covered by United States Patents Nos. 1,761,600, 1,854,831, 1,900,958, 1,900,959 and 1,900,961 owned by the Semet-Solvay Engineering Corporation.

SEMET-SOLVAY
ENGINEERING CORPORATION

Engineers ▾ *Contractors*

40 RECTOR ST. ▾ NEW YORK, N. Y.

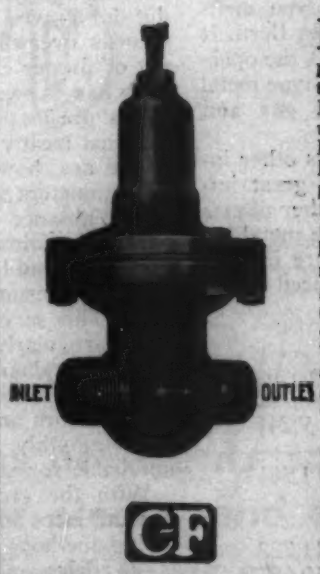
The Outstanding Gas Purifying Material » » »

Purifies *much more* gas than the same quantity of any other purifying material, while it also effects the purification in much *shorter time.*

Write for interesting booklet

THE ALPHA-LUX COMPANY, Inc.
192 Front St., New York
Philadelphia Chicago

Little Hercules Regulator Controls High Pressures



EXTREME high pressures, up to 1,000 pounds, can be reduced to anything below 5 and 100 pounds as desired, by use of the Little Hercules Regulator. And the Little Hercules weighs only 8 pounds. It is designed for use in conjunction with the Fulton House Regulator since engineers do not favor carrying high gas pressures to the point of distribution with only one valve to control them. The Little Hercules is also adapted for use wherever a small spring-type relief valve is needed.

Chaplin-Fulton equipment for all forms of pressure control has been known and commended for forty years. Literature on request.

CF

THE CHAPLIN-FULTON MFG. CO.
28-40 Penn Avenue Pittsburgh, Pa.

Competitive Fuels for Industrial Purposes

(Continued from page 16)

gets not one cent more. But improvement in quality need not be and is not always expressed in additional return. It may result in the elimination of one or more subsequent operations. The production of a bright finish eliminating pickling on non-ferrous hollow ware is an example of such a case. Another saving is in the elimination or reduction of rejections. This not only brings about a saving in manufacturing costs by reducing the unit cost of overhead but actually increases the gross revenues as well. In rolling billets a reduction in scale formation from 3% to 2% means a saving of 20 lbs. per ton of metal, or, expressed in another way, there is available after heating 1960 lbs. instead of 1940 lbs., which at 2 cts. per lb. is 40 cts. to be credited to the fuel application. Actually, the savings in scale very often go from 3% to 1%, giving 80 cts. advantage to the use of gas. With a 55-ct. rate and using 4000 cu. ft. per ton, the net cost of gas is not $2.20 but $1.40.

Similarly in the subsequent example, it will be seen how the reduction in dross formation (an inevitable result but subject to some control) pays for a large portion of the fuel bill itself. In this case, this single item also eliminates the cost of fuel after the change over to the improved system. The comparison given below is abridged from a most complete study of stereotype melting processes made by N. E. Bertl. It represents as of May, 1930, the operating results on immersion type metal melting equipment using gas and electricity.

The following data gives other information which is of as great importance. It represents other phases of a change over being the metal requirement in a plant where immersion melting with gas replaced external gas firing:

Dross Formation:

	lbs. per month
External	10,792
Immersion	9,241
Saving	1,551

Saving in new metal purchased:

External	11,722
Immersion	10,687
	1,035

Is there any wonder then why an improved quality is definitely a part of the fuel utilization problem. Profits are made as much in the manufacture as in the selling. The industrial gas man has as perfect a right to count in these costs as to penalize his operation by including air or gas compression costs.

Table 1

COMPARATIVE COST OF STEREOTYPE MELTING

	Immersion Gas Heavy Duty	*Immersion Electric, Heavy Duty*
Time of test	1 hr. 8 min.	1 hr.
Fuel consumption	1682 cu. ft.	202.0 kw.h.
Standby loss	267 cu. ft.	15.3 kw.h.
Net consumption	1415 cu. ft.	186.7 kw.h.
Metal cast	17,340 lbs.	18,688 lbs.
Metal added	15,086 lbs. cold 2,973 lbs. hot	..... 18,688 lbs. hot
Total	18,059 lbs.	18,688 lbs
Heat in added metal	19,306 B.t.u.	122,000 B.t.u.
Fuel equivalent	36 cu. ft.	35.2 kw.h.
Fuel requirement to melt from cold	1451 cu. ft	221.9 kw.h.
Fuel consumption per lb. cold metal	.0805 cu. ft.	.0118 kw.h.
Overall consumption per lb. cold metal	.095 cu. ft.	.0127 kw.h
Consumption per ton	190 cu. ft.	25.4 kw.h.
Rate	90 cts. M cu. ft.	2 cts. kw.h.
Fuel cost	$.171	$.508
Compression	.708 KWH/ton	None
Cost	$.0146	None
Total cost	$.1856	$.508

Records

Just as the army lives on its stomach so does the field salesman live on his data and records. But just as we dig our graves with our teeth so do records overwhelm the salesman if not of proper character. Each company has its own forms and it always seems presumptuous to me to offer personal means for others to follow. There are, however, certain indices or barometers which show the way. In the absence of other information a record of installed and connected equipment and load together with the monthly consumption is a good index. This serves to show the trend and particularly if kept in such a way that abnormal conditions are apparent at once. By reason of seasonal factors and cut-throat competition monthly percentages are too unreliable for any accurate studies.

With the growing acceptance of demand rates and the use of demand billing methods a remarkable index is available. By comparing the monthly usage with the recorded maximum demand, an operating index is soon found which represents the plant activity. As long as a plant operates on an even keel the Index: Monthly Consumption divided by the Maximum Hourly (Daily) Demand remains relatively constant. When, however, the index shifts suddenly, immediate attention is needed. It would be very instructive to illustrate this statement with an example but the space required for such an analysis here is not available. It is sufficient to say that the average monthly indices for a certain plant over a period of 4½ years show a value for C/D of 265 ± 15. A variation in this factor was found every time a change in operations occurred within a billing period and the investigational calls became uncanny to the shop superintendent.

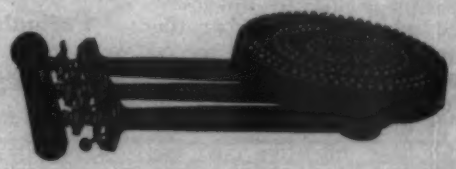
The value C/D has a far greater value, however, to the industrial gas man, for it is a measure of the load factor. If the hourly demand is the basis as in this case it shows a load of 265 maximum hours monthly or almost a 36% load factor including Saturdays and Sundays or over 50% for the working days. Where else but in an industrial installation can such a load factor be found and how else can the management visualize the justice of lowest rates for industrial gas service? Such a presentation of typical customers plus the doctrine of incremental rates for high load factors should impress the statisticians and make the road of the industrial specialist easier in the battle for the major share of competitive fuel business.

GPM
IRON HYDROXIDE

Play safe this winter.
Fill your boxes with
g.p.m.

Gas Purifying Materials Co. Inc.
Foot of Halsey St
Long Island City, N.Y.
Branch Yard
Providence R.I.

JOHNSON
RING BURNERS
Powerful Concentric Types



The famous 60BCE Triple Atmospheric Gas Burners are designed and built to operate at the highest possible efficiency at the lowest possible cost. They are made up of three independent burners which can be used singly, in pairs, or in triple. The heavy A.G.A. Valves are equipped with Johnson Patented Direct Jet Regulators. Write for full details covering Johnson 60BCE Burners and other types of Johnson Ring Burners.

JOHNSON GAS APPLIANCE CO.
Cedar Rapids IOWA

Western Representative—
C. B. Babcock Co.,
135 Bluxome St.,
San Francisco, Calif.

Eastern Representative—
C. E. Barbe,
3111 West Allegheny Ave.,
Philadelphia, Pa.

ISBELL-PORTER COMPANY

Engineers and Contractors for Complete Gas Works

I-P C

Manufacturers of All Kinds of Gas Apparatus

NEWARK, NEW JERSEY

IMPORTANT Notice to Subscribers

The American Gas Journal has no agents soliciting subscriptions. To insure proper credit send all subscription and renewal orders direct to us at

53 Park Place, New York, N. Y.

High Pressure Storage

(Continued from page 21)

oil vehicle has dried the aluminum will be absorbed by the base paint, noticeably discoloring the absorbed sections. This absorption is more rapid and noticeable where the sun's rays directly strike the tank surface. When an ordinary colored oil vehicle paint is used as the finish coat above the inhibitive base coat this absorption does not occur as the oil forms a skin which is non-soluble in the inhibitive paint. However, the forming of this skin is a disadvantage if the base inhibitive coat has been placed in too thick a layer, as the oil vehicle paint has a higher coefficient of expansion and contraction, which will result in the final coats cracking, and any rubbing of the surface will cause the final coats to peel off in sheets. The use of inhibitive paints will require closer supervision and more careful training of painters than other types of protective coats because of the reasons mentioned. Therefore, the painting operation is seldom contracted out because of a paint contractor's lack of experience with inhibitive paints. When inhibitive types of paint are applied to the steel at the mill the prime coat is in a thin layer and of a type which hardens. This hardening type will come off more readily than the types applied in the field and have not the lasting qualities. A field coat may readily be applied over the mill priming. The temporary mill primer will not decrease the effectiveness of the field primer.

Formulae Used in Connection With Storage

$C = 2\pi r = \pi D$

$A = \pi r^2 = \frac{1}{4}\pi D^2$

$S = 4\pi r^2 = \pi D^2$

$Vol. = 4/3\pi r^3 = 1/6\pi D^3$

C = Circumference of a circle in same units as r or D.

A = Area of a circle in same units as r or D.

S = Surface of a sphere in same units as r or D.

Vol. = Volume of a sphere in same units as r or D, and is termed cubical contents or displacement.

r = Radius.

D = Diameter.

π = A constant = 3.1416.

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The amount of soluble material obtained by extracting coal with benzene, acetone, etc., increases with increasing fineness of subdivision of the coal in such a manner as to confirm the assumption that the solvent penetrates only a surface layer of the coal of 0.5 micron thickness. The coal must therefore be ground to micron fineness before all the soluble material can be extracted. The amount of extract obtained from brown coals, however, is almost independent of particle size. Grinding in vacuo for 16 hours suffices to reduce a bituminous coal to micron size, although this may not be apparent under microscopical examination, owing to balling together of the particles. This balling together, however, does not affect the subsequent extraction. Extraction with benzene proceeds initially at a rapid rate, after which the yield of extract becomes a linear function of log time. The fraction of the extract soluble in pentane is removed completely in the initial period. The successive extracts vary from soluble oils to difficultly soluble shellac-like bitumens. The small differences in their elementary composition indicate that the components of bituminous coal differ more in their state of polymerization than in their composition.

K. Peters & W. Cremer, Angew. Chem. 47, 576-78 (1934)

SIMPLE METHOD OF TECHNICAL GAS ANALYSIS

In the usual method of gas analysis of the gases free from hydrocarbons high values for carbon monoxide are frequently obtained owing to incomplete absorption of oxygen by the pyrogallol and subsequent absorption of the cuprous chloride. To avoid this error it is recommended to mix a known volume of air with the gas, remove the carbon dioxide with aqueous KOH, pass the mixture over a glowing platinum spiral to burn the carbon monoxide, again remove the carbon dioxide with aqueous KOH, add a known volume of hydrogen and again pass the gas over the spiral. The method can also be used for combustible gas containing hydrocarbons provided that the calorific value and moisture content are determined and a standard curve is constructed. Apparatus for making the analysis is described and expressions given for calculating the results.

H. Schwiedessen & G. Barth, Arch. Eisenhüttenwerke 8, 15-20 (1934)

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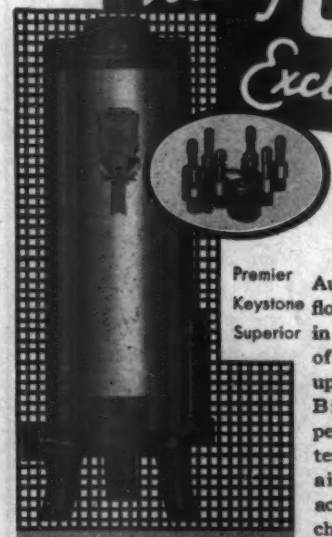

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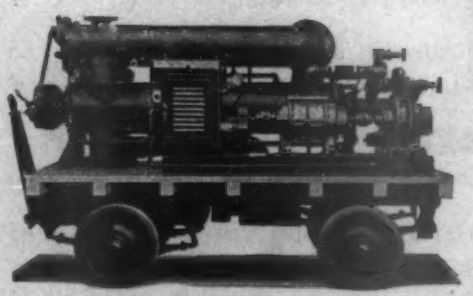

Harrison Purging Machines meet one of the fundamental requirements outlined by the A. G. A. in a recently published report covering purging procedure, namely: "An adequate supply of inert gas." This report further says: "Steam is not an equivalent for inert gas." The attitude evidenced was clearly that now that inert gas units are commercially available, all works equipment containing flammable gas should be purged when removed from service. Write for Bulletin 100-B12.

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